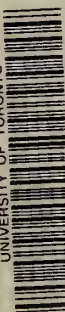


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THE BOMBAY PLAGUE,

BEING

A History of the Progress of
Plague in the Bombay
Presidency from

September 1896 to June 1899.

COMPILED,

UNDER THE ORDERS OF GOVERNMENT,

BY

CAPT. J. K. CONDON,

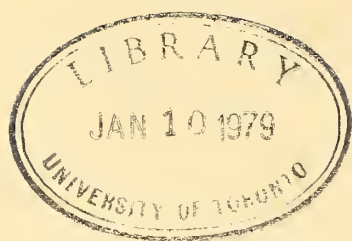
Indian Staff Corps.

1900.

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P R E F A C E.

A REPORT on Plague in India from September 1896 to August 1897, compiled by Mr. R. Nathan, I. C. S., was published under the orders of the Government of India in 1898; and a report on Plague in this Presidency for the same period, compiled by Mr. Couchman, I. C. S., was published under the orders of this Government in September 1897. Subsequently, neither the Government of India nor this Government have issued any comprehensive report on Plague; but reports have been issued by other Governments in whose territories the pestilence has appeared. They are as follows:—

- (1) Report on Plague in the Hoshiarpur and Jullundar Districts (Panjab).
- (2) Report on Plague in the Central Provinces.

The Government of Bombay have decided that it is desirable, if not indeed necessary, that some account of the history and progress of Plague in this Presidency during the past two years, together with the efforts made to repel and to combat it, should be placed on record. The main objects aimed at in this Report are—a comprehensive record of the rise and progress of the disease in this Presidency from May 1897 to June 1899, with its effects, both good and bad: the delimitation of our present knowledge of its origin, growth, dissemination and treatment: the results attained by the preventive and combative measures actually adopted: and a work of reference.

The sources from which this Report has been compiled are many and various. They may be summarised briefly as follows:—Reports of other Governments; reports of Government officials, and others specially employed on Plague duty; reports of specialists and experts; miscellaneous works on Plague. In this connection special acknowledgment is due to Major W. B. Bannerman, I. M. S., and Capt. C. J. R. Milne, I. M. S.,—to the first of whom is due a large share in the Chapters on Inoculation and the Rise of the Plague Research Laboratory, and also the revision of the Chapter on the Medical Aspects of Plague: and by the second of whom the Chapter on the Bacteriology of Plague was specially written for this work: to Mr. E. Sands, late Superintendent of the Plague Department, whose great experience of Plague records, and whose help in the correction of proofs, and in suggestions regarding the Report generally, have been most valuable: to Major J. Crimmin, V. C., I. M. S., and to Dr. E. L. Marsh for much miscellaneous assistance.

An Index, carefully and methodically compiled, by Dr. Cuthbert Christy, on Special Plague Duty, has been added for facility of reference.

Executive Plague duties have, unfortunately, seriously interfered with the up-keep of accurate and detailed Plague records. Plague appears in a place, sweeps off anything from one-tenth to one-third of the population in a few months, and then disappears, leaving no time for the Plague staff to do more than attend to the wants of the stricken and provide for the protection of the healthy. Records kept under such conditions as these, where a continued series of close observations concentrated on one particular point have been impossible, preclude any but the most hesitating deductions.

It has been considered better to insert charts, maps, etc., in their proper places, than to collect them in a separate volume.

The period properly embraced by this Report is from 4th June 1897 to 2nd June 1899, and events outside these dates are very briefly dealt with. For details of the first year's Plague and Plague measures, therefore, Nathan's or Couchman's Reports should be referred to.

For those whose interest in the subject of Plague extends beyond the limits of this volume, a Chapter—though by no means an exhaustive one—on Plague Literature has been added.

Bombay,
30th November 1899.

J. K. CONDON, CAPT.,
Indian Staff Corps,
Under-Secretary to Government.

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INTRODUCTION.

[The following are the sources from which this chapter has been compiled :—

Encyc. Brit. : Quain's *Dict. of Med.* : Sir A. Faulkner, M.D., *A Treatise on the Plague* : MacLean, *Epidemic and Pestilential Diseases* : Nathan, *The Plague in India* : *Bombay Gazetteer.*]

The word *plague* is derived, through the Latin *plaga*, from the Greek *πληγή* : it signifies 'a stroke.'

Plague is the most deadly of all known diseases. Obscure in its origin, persistent in its duration, terrible in its effects, it has baffled alike the investigations of science and the observations of the most perspicacious. The attitude it compels in those who are, and in those likely to become, its victims is one of abject panic. It assumes varying forms, it strikes with varying force, it rises and falls with varying rapidity.

Such is the disease which, appearing century after century, now in the most deadly epidemic, and now in a mild sporadic, form, was the scourge of Europe up to the very beginning of the 19th century. As well for the sake of completeness, as for that of interest and comparison, a brief sketch of what it has done in the past, both in the West and in the East, will not be out of place here.

PLAGUE IN EUROPE.

(A. D. 542—A. D. 1841.)

Previous to
A. D. 1300.

The first historical notice we have of Plague is contained in the fragment of the Physician Rufus of Ephesus, preserved by Oribasius (*circ.* B. C. 200) ; but although mentioned later by Livy and by Orosius as destroying one million people in Africa, it is not until the 6th century, in the reign of Justinian, that we find Bubonic Plague in Europe.

Beginning at Palusium (Egypt) in 542 A. D., it spread over Egypt ; in 543 it reached Constantinople, where it is said to have destroyed 10,000 people in one day ; in 546 we find it in Gaul (France) ; in 565 in Italy, "where it depopulated the country to such an extent as to leave it an easy prey to the Lombards." Constantinople was, thus, we see, the first haunt of Plague in Europe ; and it appears to have been the starting point for most, if not all, succeeding European epidemics.

But although Plague appeared thus early in Europe, it was not until very much later that it appeared in England.

The history of Plague from the time of the Justinian pandemic is very vague until we reach the 14th century, when that great cycle of epidemics known as the "Black Death," swept over Europe, inflicting enormous mortality.*

* "Whether in all the pestilences known by this name the disease was really the same may admit of doubt, but it is clear that in some at least it was the *bubonic plague*."—*Encyc. Brit.*, Art. "Plague."

"It must, however, be remembered that although numerous pestilences in Europe are recorded by mediæval chroniclers, there is no sufficient evidence, before the 14th century, that they were bubonic plague. The undoubted prevalence of this disease began after the black death of the fourteenth century."—*Quain's Dict. of Med.*, Art. "Plague."

14th Century.
"The
Black Death"

This frightful scourge appears to have originated in the East, and to have entered Europe *viâ* Tartary and the Crimea. According to old Russian chronicles, its origin was China, where, as is confirmed to some extent by Chinese records, pestilence and inundations are at this time (1300-1400) said to have destroyed the enormous number of thirteen millions. Appearing first in Sicily and Constantinople in 1346, it invaded Greece, parts of Italy, and Marseilles in 1347; in 1348 it attacked Spain, Northern Italy and Rome, Eastern Germany, many parts of France, including Paris, and England, including London, whence it spread to Scandinavia. Oxford was attacked in 1352. Scotland and Ireland, too, though affected later, did not escape.

The death-tribute exacted by this terrific wave of pestilence was appalling. It is estimated that three-fourths of the population of England perished*; while Europe is calculated to have lost one-fourth of its inhabitants—*twenty-five millions of people*. †

15th Century.

In the 15th century the pestilence re-appeared frequently in almost every part of Europe: carrying off 80,000 in Dantzic and the neighbourhood in 1427: 40,000 in Paris in 1466: while Northern Italy was devastated in 1477-85, and Brussels in 1485. In the last year of the century (1499-1500) a severe plague in London caused King Henry VII. to retire to Calais.

16th Century.

The 16th century was not more free from the scourge than the 15th; but it constitutes an important epoch in Plague: for, about 1550 A. D., *the question of contagion was first raised*. Plague had also henceforth to be distinguished from Typhus fever, which, during this century, made its first appearance in Europe.

Edinburgh was attacked in 1529: London and the north of England in 1537 and 1547: Italy and Germany about the same time; while in Paris about this time plague was an every-day occurrence, familiarity with which had bred contempt. Severe epidemics occurred at Moscow and in the neighbourhood (1570), in which 200,000 perished; at Lyons (1570), plague mortality—50,000; at Venice (1576), where 70,000 were carried off.

17th Century.

In the first half of the 17th century the pestilence was still prevalent in Europe, though considerably less so than in the Middle Ages: in the second half a still greater decrease took place: while in the next 25 years it was disappearing rapidly from Western Europe.

Two noteworthy epidemics, nevertheless, were recorded during this century. The first—one of the most terrible and destructive of all recorded European epidemics—raged at Naples in 1656: where it destroyed 300,000 people in 5 months. Genoa also lost 60,000 in this epidemic.

* "In England a great part of the country remained untilled, and the deficiency of labourers was such as to cause a sudden rise of wages, which, in spite of attempts to check it by legislation, is believed to have effected the final emancipation of the labouring class. On the other hand, a great transfer of property to the Church took place—with what results is well known."—*Encyc. Brit.*, Art. "Plague."

† Hecker's estimate.

The second was the great Plague of London; in which, out of an estimated population of 500,000 (two-thirds of whom are supposed to have fled panic-stricken), 68,000 perished within the year.*

From 1666 England was free from Plague. A few sporadic cases indeed occurred up to 1679, and a column filled up with "0" is found in the bills of mortality up till 1703; when it finally disappeared. For its disappearance from England now (1679), as for its disappearance from the Continent of Europe later, no reason can be assigned.

18th Century.

In the 18th century Plague was more or less confined to Eastern Europe, although in 1720-1722 a severe outbreak occurred in Provence; Marseilles and Toulon being attacked. In this outbreak, out of a total population of 250,000, 87,500 are said to have perished. The Provence epidemic is noteworthy because of the panic it caused in England: *where in consequence quarantine was enforced for the first time*. In 1717 Plague re-appeared at Constantinople: 1719 in Transylvania, Hungary and Poland: 1743 in Sicily: 1738-1744 in Hungary, Moravia and Austria: 1755 in European Turkey: 1770 in Moldavia (during the Russo-Turkish War), Poland, Kieff, and Moscow, at which latter place it developed into one of the most destructive epidemics of modern times. Over 50,000 persons—nearly one half of the population—perished. From 1770 the disease, while re-appearing in the haunts of the terrible early epidemics, was more limited both in range and duration. In 1799 and 1800 a new epidemic in Syria and Egypt affected both the French and the English Armies which were operating there.

19th Century.

Throughout the 18th century the tide of Plague had steadily ebbed away from the West; in the 19th century this ebb was still more marked. In 1802 Plague appeared at Constantinople and Armenia: in 1806 at Astrakhan (Russia): in 1808 at Smyrna. In 1812 a more general epidemic affected these places and also Egypt. From 1813-1815 it appeared in Bucharest, Malta, Corfu, Dalmatia and Egypt: in 1815 at Noja on the East Coast of Italy—so far its last appearance in that country—and produced a panic throughout Europe. In 1824 it attacked Tutchkoff in Bessarabia, but the town was strictly isolated by a military Cordon, and the disease did not spread. In 1828 it appeared in Cronstadt, and is believed to have been again confined by similar action. In 1828-9, during the campaign of the Russian Army against Turkey, a more serious outbreak occurred: for Plague appeared in Odessa, the Crimea, Moldavia, Wallachia, and Bessarabia; but it spread no further; its limitation being again attributed to the Russian and Austrian military Cordons. In 1831 Constantinople and Roumelia suffered from Plague; in 1837 Roumelia and Odessa; and, with an isolated outbreak in Dalmatia in 1840, and one in Constantinople in 1841, the Plague-History of the European Continent comes to a close.

* "This number is likely to be rather too low than too high; since, of the 6,432 deaths from spotted fever, many were probably really from plague, though not declared so to avoid painful restrictions."—*Encyc. Brit.*, Art. "Plague."

With such a previous record, the recent appearance of Plague in Portugal and Spain cannot be regarded without anxiety.

At the present time there are believed to be three endemic haunts of plague. The first in Mesopotamia ; the second in Gahrwal and Kumaon at the foot of the Himalayas in the North-West Provinces : the third in Yunnan in China.

Dr. Koch mentions another endemic centre, which is situated in Africa (near lake Nyassa), and is supported in this view by Dr. Proust.

PLAGUE IN INDIA.

(Up to September 1896.)

Before
1800 A. D.

We cannot in the case of India trace the history of Plague century by century. Up to 1800 a reliable historical document is a *rara avis*. We can only record the instances where mention is made of Plague under such terms as '*Waba*,' '*Ta'un*,' etc., and conjecture how far the statements are accurate, and to what extent the pestilence referred to is identical with that which is amongst us now. But even such references as these are rare. The following brief summary of what is known on the subject is taken from Nathan's *Plague in India* :

"Only two direct references have, however, been traced which may point to the existence of Plague in the west of India in the fourteenth and fifteenth centuries. The first is from Ibn Batuta, who notices that Muhammad Tughlak's army in Ma'bar (1325-1351) mostly perished of pestilence, and that at the end of the century (1399), after Timur left, the districts through which he had passed were visited by pestilence. The second relates to the year 1443, when pestilence caused such loss of life in the army of Sultan Ahmad I. that, leaving many of the dead unburied, he retired to Gujarat. Ferishta calls this disease *ta'un*, and speaks of it as very unusual in India. The famine of 1590 to 1594 was followed by a pestilence that, besides hamlets and villages, depopulated whole cities. It must remain a matter of conjecture whether these outbreaks of virulent pestilence were epidemics of true Plague.

"Twice in the seventeenth century the district of Ahmedabad in the Bombay Presidency was visited by severe epidemics of pestilence which were probably outbreaks of Plague. The *Bombay Gazetteer* gives the following description of the first of these epidemics, which appears to have been very widespread :—

"The disease that raged in Ahmedabad in 1618 began in the Punjab in 1611. It is called the plague, *Waba* or *Waba-o-ta'un*, and the works of the Hindus are said to have no mention of such a disease. It was thought to be connected with the comet of 1612. From the Punjab it spread through Lahore, through the Doab to Delhi, and north to Kashmir. No place in Hindustan was free from its ravages. Lulling at times, it continued to lay waste the country for eight years. About the same time in Kandahar the land was overrun by mice, and mice and plague seem to have had some close connexion. A mouse would rush out of its hole as if

mad, and striking itself against the doors and walls of the house, would die. 'Then the plague was in the house. If the people at once fled they might be saved; if they stayed, the whole village was swept away.'

"With reference to the second outbreak which occurred during the period 1683 to 1689, the *Gazetteer* makes the following remarks: 'For several years before 1689 the plague, *Tá'un* and *Wabá*, was again in Ahmedabad, and lasted for seven or eight years. The visible marks were swellings as big as a grape or banana behind the ears, under the arms, and in the groin, and redness round the pupils of the eyes.' Hirsch repeats the following quotation made by Macpherson ('Annals of Cholera,' London, 1872) from an Indian chronicle which apparently refers to this epidemic: 'A fever had prevailed for some years both in the Deccan and in Gujarat. It consisted of a slight swelling under the ears, or in the armpit or groin, attended with inflamed eyes and severe fever. It generally proved fatal in a few hours.' Hirsch remarks that this description is suggestive of plague.

"It is stated in the *Ahmedabad Gazetteer* that during the eighteenth century, though none of the symptoms of the disease are described, there would seem to have been several outbreaks of a most deadly form of fever. In 1718, a year of famine, great numbers died of sickness; in 1770, another famine year, 'on account of the unwholesomeness of the atmosphere, thousands of people died of fever in two or three days, so that no one could be found to bury them.' Fearful disease is said to have accompanied the 1790 famine."

The
Gujarat Epidemic,
1812-1821.

From the year 1800, however, the sources of information are reliable, and we have authentic records of at least two great epidemics. The first of these was the Gujarat epidemic of 1812-1821.

Breaking out first in Cutch in 1812, and spreading thence over Kathiawar, Ahmedabad, and Southern Sind, it devastated Western India for a period of ten years. The years 1811 and 1812 were remarkable for a severe famine which affected the larger portion of Gujarat. It was at the close of this famine that the Plague appeared in Cutch.

Cutch is said to have lost half its population during this epidemic. Two Medical Officers, Drs. Gilder and White, visited the country at the time, and wrote accounts of the disease: *and the pneumonic form of plague was now discovered for the first time by Dr. White, who gives the following interesting description of its symptoms:—*

"In this man the heat of the body was not much increased nor the pulse greatly accelerated; his bowels were not disordered, nor did his tongue indicate much febrile irritation. He was able to walk about and converse, answering questions distinctly. No person would have thought him in danger, but there existed in the patient's mind a degree of alarm and anxiety altogether disproportionate to the apparent symptoms. He had

The first notice
of pneumonic
plague.

“only been attacked that morning. All his consideration seemed absorbed with a pain in his chest. He answered to my questions whether he had not other pain, as in his head, his back or limbs, that these were slightly painful; but he immediately recurred to his chest, dwelling upon that with a look of most painful distress; and if not questioned about other symptoms, it seemed as if he would not have mentioned them. He had besides a very slight cough—so light that it might easily have escaped unnoticed—and this was accompanied with a discharge of blood from the mouth. The following day he was delirious, had a burning skin, with a very quick pulse. I searched for, but found no buboes. He died in the course of the succeeding night, *i.e.*, in less than forty-eight hours from the first attack. The characteristic symptoms of this variety are, slight cough, pain of the chest, and hæmorrhage from the mouth, attended with fever, but no buboes.”

**Mild Bubonic
Plague.**

Dr. White also observed a “mild bubonic type,” which he describes as follows:—

“I saw,” he states, “a great number who had buboes without any fever, and was told that upwards of one hundred and twenty had suffered in this way. These people walked about without either alarm or inconvenience, for none had died, and not many of the buboes suppurated.”

Quain also records a similar form*:—

“In 1877 an outbreak occurred at Resht, the capital of the province of Ghilan, Persia, and in the surrounding district. Ghilan lies at the south-west angle of the Caspian Sea. The same year cases of a fatal bubonic febrile malady occurred in the District of Baku on the Caspian shore of Trans-Caucasia: and an outbreak of a non-fatal bubonic affection took place in Astrakhan and its vicinage, since recognized as a form of plague.”

It is interesting to note that the same form occurred in Cutch last year, and is thus described by the Political Agent, Major Hyde Cates†:—

“During the last three months of the year under report (*i.e.*, March, April, and May 1899), several cases have occurred in which there has been a bubo (generally in one of the arm-pits), but without fever. The person attacked has suffered from headache for a day or two, but has not otherwise been inconvenienced.”

**The Pali
Epidemic
1836-1838.**

The second epidemic was the Pali outbreak of 1836-38; although a disease suspiciously akin to plague was discovered by Col. Skinner at Hansi (Punjab) in 1828-29.

The Pali outbreak occurred in the District of Merwara, between the State of Jodhpore on the north, and the State of Udaipur on the south. Breaking out in July 1836 at Pali, a large town in Marwar, where it destroyed some 4,000 people,

* Quain's *Dict. of Med.*, Art. “Plague.”

† Cutch Political Agent's Report No. 339 of 24th July 1899.

it spread to Sujat (population, 6,000) and Jodhpur (capital of Marwar); affecting all the intervening towns and villages. From June to March 1837, it attacked the villages of Dewair, Deoghar, Lucanithana, Bednore, Jalia and Ranghar (Ajmere). In April 1837 it spread in the direction of Neemuch Cantonment, two villages in Merwar being attacked. Towards the end of 1837 it again appeared in Pali and did not die out until the Spring of 1838. The total mortality of this epidemic is not known with any certainty; but it is estimated that 100,000 Marwaris perished. Apart from these great epidemics which have occasionally visited India, and apparently unconnected with them, there is an epidemic centre of plague at Gharwal and Kumaun at the foot of the Himalayas. These two Districts, situated in the North-West Provinces, with an area of over 11,000 square miles, contain a population of nearly 1,000,000 persons. The disease is here called *mahamari*; but Assistant Surgeons Francis and Pearson, who investigated the disease locally in 1852, arrived at the following conclusions:—

- (1) Mahamari and Plague are identical.
- (2) Mahamari is of local origin: capable of transmission from person to person and place to place.
- (3) That it is gradually extending itself, and that there seems no reason why it should not be developed in the surrounding country.

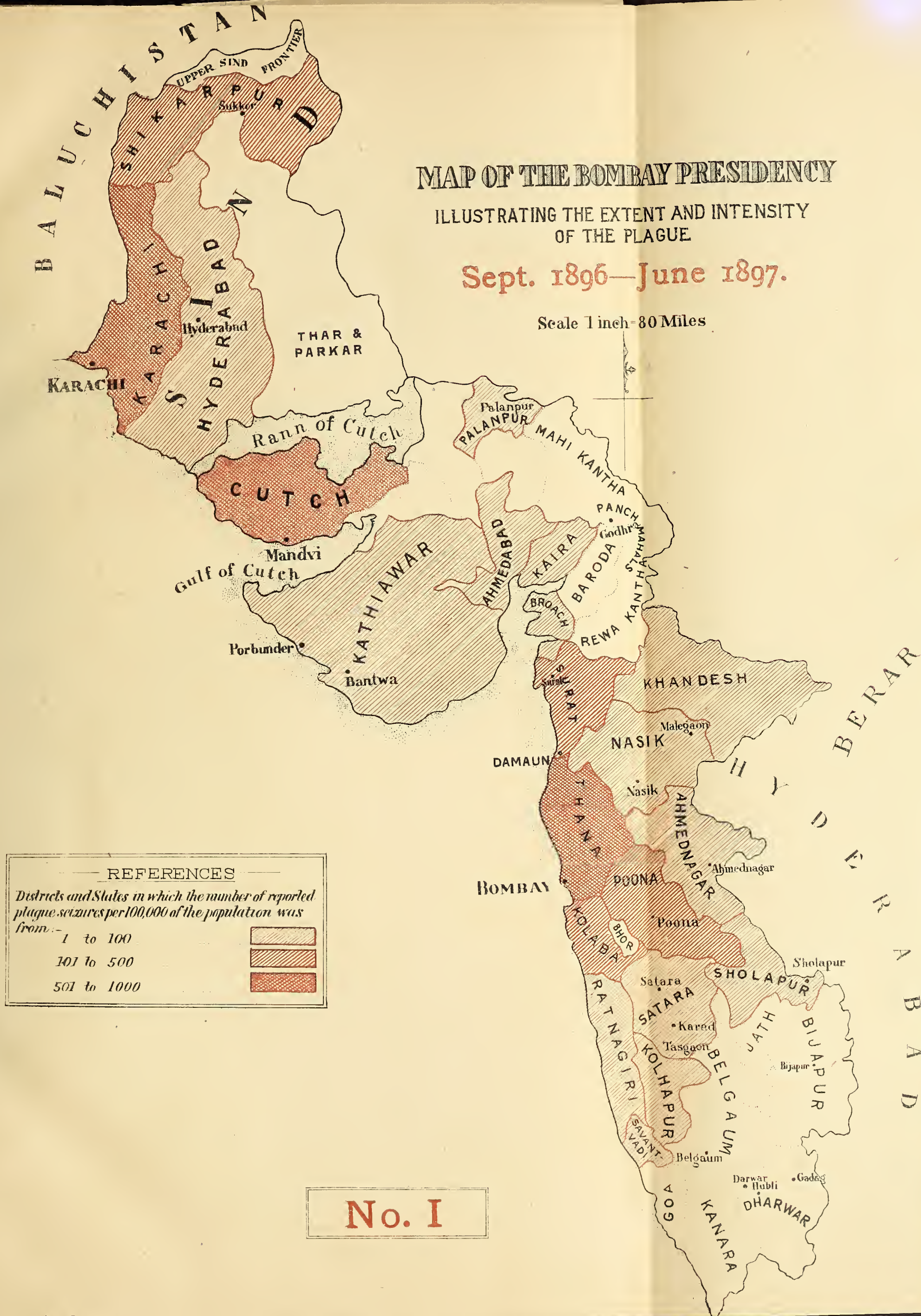
A little more detail as regards former epidemics in Districts in this Presidency is given in the chapters devoted to the recent outbreaks of Plague in such Districts; but for full details, "Nathan's Plague in India," 1896-97, Vol. I., should be consulted.

MAP OF THE BOMBAY PRESIDENCY

ILLUSTRATING THE EXTENT AND INTENSITY
OF THE PLAGUE

Sept. 1896—June 1897.

Scale 1 inch=80 Miles



CHAPTER I.

GENERAL REVIEW.

Part I.—Plague in the Presidency.

September 1896 to June 1899.

(NOTE.—The populations assigned to Districts, Towns and Villages as far as page 150 of this volume, are those of the Census of 1891 taken from the Sanitary Commissioner's Annual Report for 1898; after page 150 or in cases where they cannot be found in the Sanitary Commissioner's Report, they are taken from the Administration and Collectors' Annual Reports.)

The present series of Plague epidemics in India began in Bombay in August 1896. But the disease was not recognised till September 23rd, when Dr. Viegas, a Private Practitioner in Bombay, stated publicly that there was plague in the City, and made an official report to the Municipal Commissioner accordingly. The previous prevalence of the disease in Bombay City, however, is clearly demonstrated by the total weekly mortality for August and September.

Week ending	Actual mortality in 1896.	Average mortality for same period during previous five years.	Remarks.
18th August	650	559	
25th „	669	555	
1st September	629	508	
8th „	563	494	
15th „	580	459	
22nd „	613	478	
29th „	671	492	
Total for 7 weeks ...	4,375	3,545	Excess 830: or about 120 per week.

Of its actual inception, as of its origin, little or nothing is known. It is not even known in what part of the City plague first appeared. On the 29th of September the Government of India were officially informed; and, on the same date, Mr. Haffkine was sent from Calcutta to Bombay to convert medical opinion into Bacteriological certainty. On the 13th of October 1896 Bacteriological investigation confirmed the existence of Plague in Bombay City.

FIRST PERIOD.

23rd September 1896 to 4th June 1897.

The spread of the pestilence from Bombay was at first very gradual. The first District to return indigenous plague was Satara, in the South: but, on the whole, during the first year, the tendency of the spread was northwards. Up to the end of December 1896, Thana and Karáchi in the North, and Satara, in the South, were the only Districts to report indigenous plague, while imported cases were returned from Ahmedabad, Broach, Cutch, Kaira, Kathiawar, Khandesh, Mahikantha, Nasik and Surat, on the North; and from Kanara, Kolaba, Kolhapur, Ratnagiri, Savantwadi, and Sholapur, on the South.

The first three months of 1897 saw the infection of District after District: the tendency of the spread being markedly northward, as Maps Nos. I and I (a) show. As regards indigenous

plague during this first year, Belgaum, Bijapur, Broach, Dharwar, Jath, Kaira, and Kanara—all in the South—escaped scot-free ; while in the North, Thar and Parkar and the Upper Sind Frontier remained untouched. The severest epidemics of this first year, which may be taken as ending on the 4th of June 1897, occurred at Bombay, Bhiwndi, Cutch Mandvi, Damaun, Karáchi, and Poona. The following are the figures :—

1896-97.

Serial No.	Place.	Popula- tion.	Duration of Epidemic.	C.	D.	Percentage mortality on population.	Source of Infection.
1	Bombay City ...	806,144	Sep. 1896—4th June 1897.	12,425	10,562	1·29	Unknown.
2	Poona (including Cantonments and Suburbs)	161,696	Sep. 1896—May 1897 ...	2,629	1,879	1·16	Bombay.
3	Karachi ...	97,009	Dec. 1896—July 1897 ...	4,178	3,390	3·45	Unknown.
4	Cutch Mandvi...	38,155	Apr. 1897—August 1897.	4,359*	3,853*	10·09	Bombay or Karachi.
5	Bhiwndi ...	14,387	Apr. 1897—August 1897.	2,335	1,741	12·10	Bombay.
6	Damaun ...	8,230	Feb. 1897—July 1897 ...	.....†	2,352*	28·58	Bulsar.

* *Approximate only.*

† *Not known.*

But all these epidemics were destined to be eclipsed by those of the succeeding years.

The total numbers of officially recorded cases and deaths throughout the Presidency during this first period of Plague were :—

23rd September 1896 to 4th June 1897.

Cases, 35,434—Deaths, 28,737.

But the actual numbers were considerably larger ; concealment, flight, late detection of the disease, all combining to prevent discovery of the real figures. An endeavour will be made in a subsequent chapter to arrive at an estimate of the true plague mortality.

Two maps are given for each period. The first series (I, II, III, &c.) show the total plague mortality in Districts, adding in that of the large Towns, without showing the latter separately.

The second series [I (a), II (a), &c.] shows the large Towns separately, and in this series the plague mortality of large Towns has been deducted from that of Districts. These last obviously give the more correct view of the actual incidence of plague.

SECOND PERIOD.

4th June 1897 to 3rd June 1898.

During the next month Plague steadily declined throughout the Presidency, until, during the week ending 16th July 1897, it was limited to rapidly subsiding epidemics in the Surat, Thana, Poona, and Kolaba districts, in Cutch and in Sind: the largest number of cases returned during this week being 25 from the Karáchi District, and the total number throughout the Presidency being 132 cases and 103 deaths (including Baroda). It was

BALUCHISTAN
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MAP OF THE BOMBAY PRESIDENCY

ILLUSTRATING THE EXTENT AND INTENSITY
OF THE PLAGUE

June 1897—June 1898.

Scale 1 inch = 80 Miles



REFERENCES

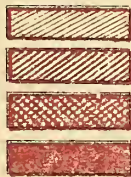
Districts and States in which the number of reported plague seizures per 100,000 of the population was from:-

1 to 100

101 to 500

501 to 1000

1001 to 2000



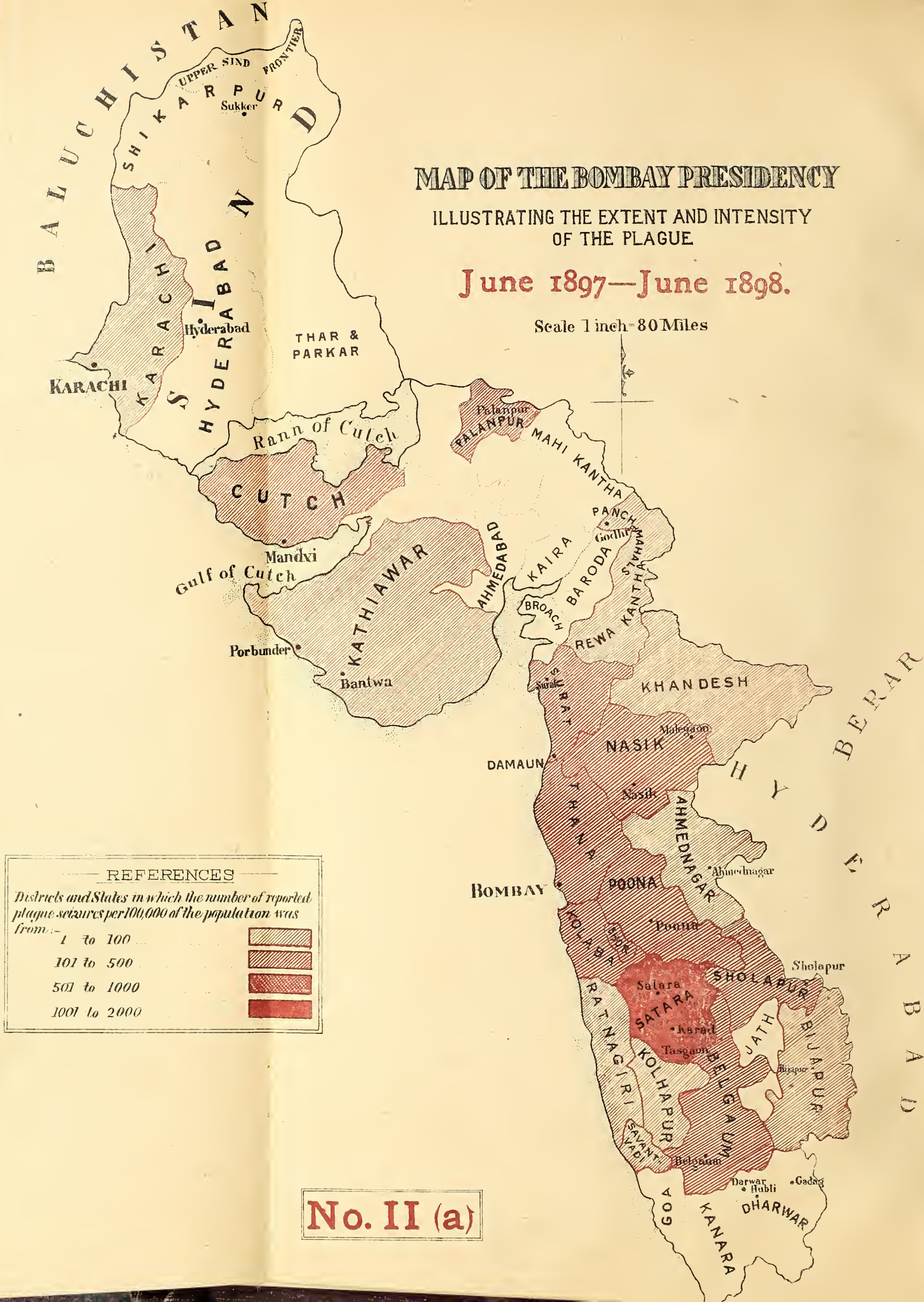
No. II

MAP OF THE BOMBAY PRESIDENCY

ILLUSTRATING THE EXTENT AND INTENSITY
OF THE PLAGUE

June 1897—June 1898.

Scale 1 inch = 80 Miles



now hoped that the pestilence would gradually disappear altogether from the Presidency. Recrudescences were perhaps feared, but not expected, at any rate in a severe form, and every effort was put forth to prevent them. Inspection of passengers by road and rail and sea ; strict segregation of those arriving from infected places, prompt isolation and disinfection where, notwithstanding all precautions, cases had been imported,—all these and many other measures were rigidly enforced to procure immunity and prevent infection from taking root. All such hopes were, however, frustrated : all efforts unavailing. In the second year Plague struck the Presidency with twice the severity of the first year—established a wider area of infection—burst out in individual epidemics of greater severity—doubled the Plague death-roll.

After the general subsidence, above-mentioned, of plague throughout the Presidency, which took place in June and July 1897, the first places to be re-infected were Karad Town (middle of July 1897), followed in a month by Surat City and District, Kalyan Town, Poona City and District, Nasik Town and District, and the Satara District, in all of which plague re-appeared during August. Kolaba District, which had never been quite free, continued slightly infected throughout; and though the figures were small, no week passed without plague being returned from it. It, too, after a lull in July and August, became slightly worse towards the middle of September 1897. Of the Native States, Cutch, where plague had never quite ceased, became worse in September, the figures running over 100 per week. Mundra Town (population, 10,433) was infected towards the end of August, Palanpur Town (population, 21,092), which had suffered from a slight epidemic from February to May 1897, was re-infected in August, and succeeded in two months in infecting the rest of the State. About this time Aundh State became infected for the first time.

Plague in Sind throughout this second year was limited to a slight outbreak at Kotri (population, 7,909) which, beginning in the end of October, continued till the end of January 1898; and to a violent epidemic at Karáchi in April, May, and June 1898, a mild infection being disseminated by it to parts of the Karáchi District.

We now come to one of the most serious aspects of Plague during this second year—its dissemination and spread into other Districts, now infected for the first time. These Districts and States were Ahmednagar and Aundh—infected in September 1897; Sholapur, Belgaum, and Dharwar (the latter very slightly)—infected in October 1897; and Khandesh — infected towards the end of November 1897. Rewa Kantha followed later in March 1898.

The extent of the prevalence of plague during this second period may be seen from Maps Nos. II and II (a), and a comparison of these Maps with Maps Nos. I and I (a) will show how much fresh ground the disease had gained, and the deeper root the infection had taken.

During the first year a great part of the southern portion of the Presidency had escaped. At the end of the second year, *i. e.*, in June 1898, the following were the only places which had throughout remained free from plague :—Bijapur, Kaira, Kanara, Panch Mahals, Thar and Parkar, and the Upper Sind Frontier. Dharwar and Broach might, indeed, be added, as a great struggle was going on in each of these Districts to prevent the infection taking root—a struggle the issue of which remained doubtful until June 1898, *i. e.*, until the beginning of the Third Period.

The following statement shows the duration and total figures for the worst epidemics during the Second Period :—

1897-98.

Serial No.	1 Place.	2 Population	3 Duration of Epidemics.		4 Cases.	5 Deaths.	6 Percentage of Mortality on Population.
			From	To			
1	Bombay	806,144	June 1897	May 1898	17,997	16,532	2·01
2	Poona (including Cantonment and Suburbs).	161,696	July 1897	March 1898	6,676	5,043	3·12
3	Karáchi	97,609	April 1898	June 1898	3,608	2,376	2·41
4	Sholapur	61,564	October 1897	February 1898	2,539	2,187	3·50
5	Mandvi (Cutch) ...	38,155	April 1897	August 1897	4,295	3,808	9·98
6	Sangli State ...	18,298	February 1898	July 1898	549	500	2·73
7	Karad (Satara Dist.)	12,085	July 1897	January 1898	1,452	1,107	8·38
8	Kale („)...	4,431	September 1897	January 1898	573	465	10·49
9	Supne („)...	2,068	September 1897	November 1897	325	212	10·25
10	Magod (Surat Dist.)	2,063	March 1897	May 1897	273	210	10·12
11	Varunje (Satara Dist.)	928	September 1897	November 1897	159	146	15·73
12	Karve („)...	851	September 1897	December 1897	437	352	41·36
13	Devi Khindi („)...	690	September 1897	November 1897	122	105	15·21
14	Vadkhel („)...	343	September 1897	December 1897	93	83	24·19

The total numbers of cases and deaths reported throughout the Presidency for this Second Period were—

4th June 1897 to 3rd June 1898.

Cases, 75,813—Deaths, 61,220.

THIRD PERIOD.

3rd June 1898 to 2nd June 1899.

We have already noticed that during June and July 1897, a general and almost total subsidence of plague occurred throughout the Presidency. Some Districts were free ; others indeed still returned plague cases, but these were but the dying embers of rapidly subsiding epidemics. Other Districts again had so far not been attacked. But in no case was an epidemic beginning or were the figures rising.

To a considerable extent, though in a far less degree, the same was again true in June and July 1898. In many Districts plague had ceased altogether ; in others it was subsiding.

In the first category were Ahmednagar, Khandesh, Nasik, and Sholapur Districts in the Presidency proper ; the Hyderabad and Shikarpur Districts in Sind ; and Aundh, Janjira, Palanpur, and Reva Kantha amongst the Native States. In the second category were the Surat, Thana, Poona, Satara, Kolaba, and Ratnagiri Districts in the Presidency proper ; the Karáchi District in Sind ; and Sangli State.

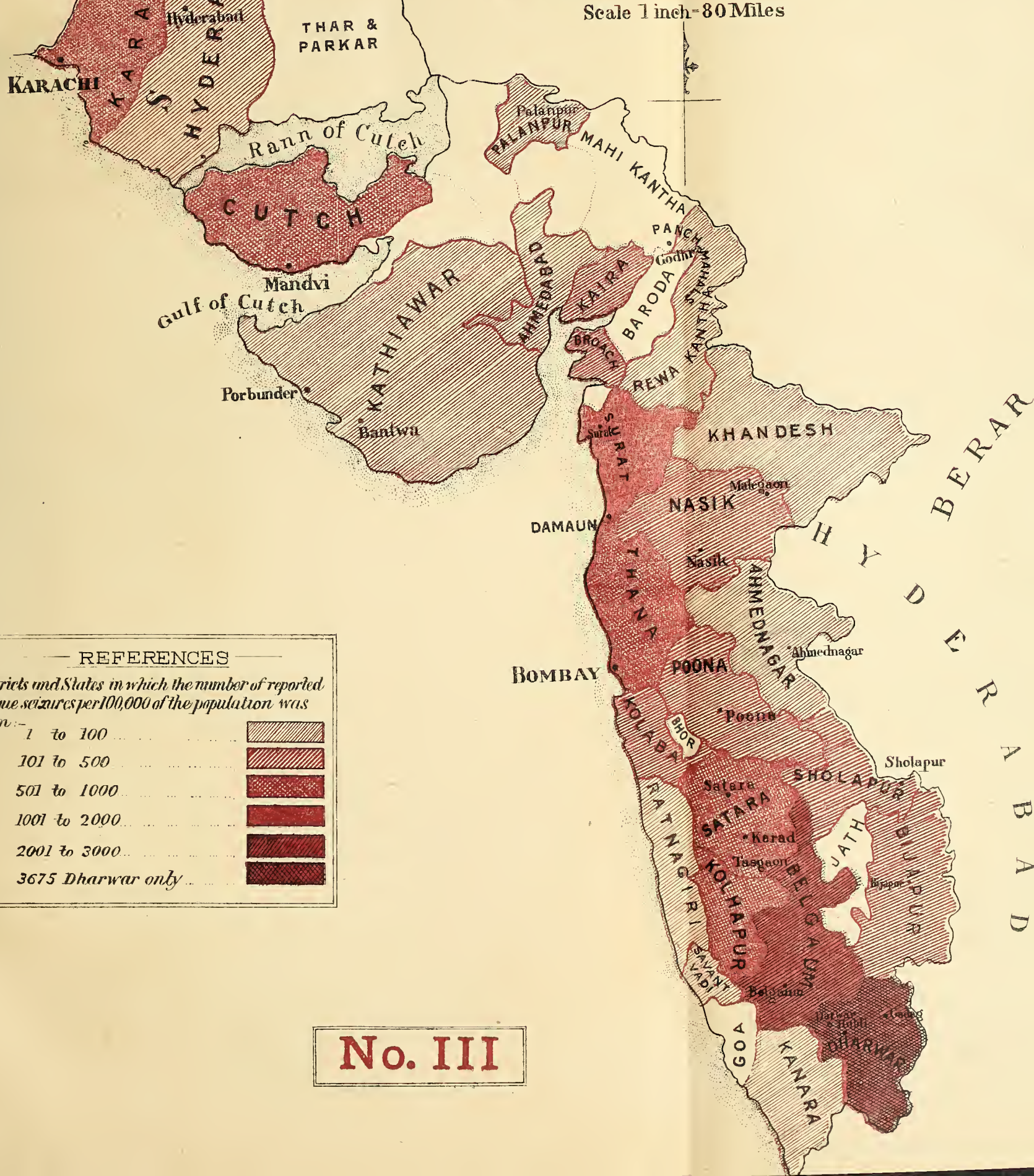
BALUCHISTAN
SHIKARPUR
UPPER SIND FRONTIER
Sukker

MAP OF THE BOMBAY PRESIDENCY

ILLUSTRATING THE EXTENT AND INTENSITY
OF THE PLAGUE

June 1898—June 1899.

Scale 1 inch=80 Miles



REFERENCES

Districts and States in which the number of reported
plague seizures per 100,000 of the population was
from:-

1 to 100

101 to 500

501 to 1000

1001 to 2000

2001 to 3000

3675 Dharwar only



No. III

BAUCHISTAN
SHIKARPUR
UPPER SIND FRONTIER
Sukker
HYDERABAD
Karachi

MAP OF THE BOMBAY PRESIDENCY

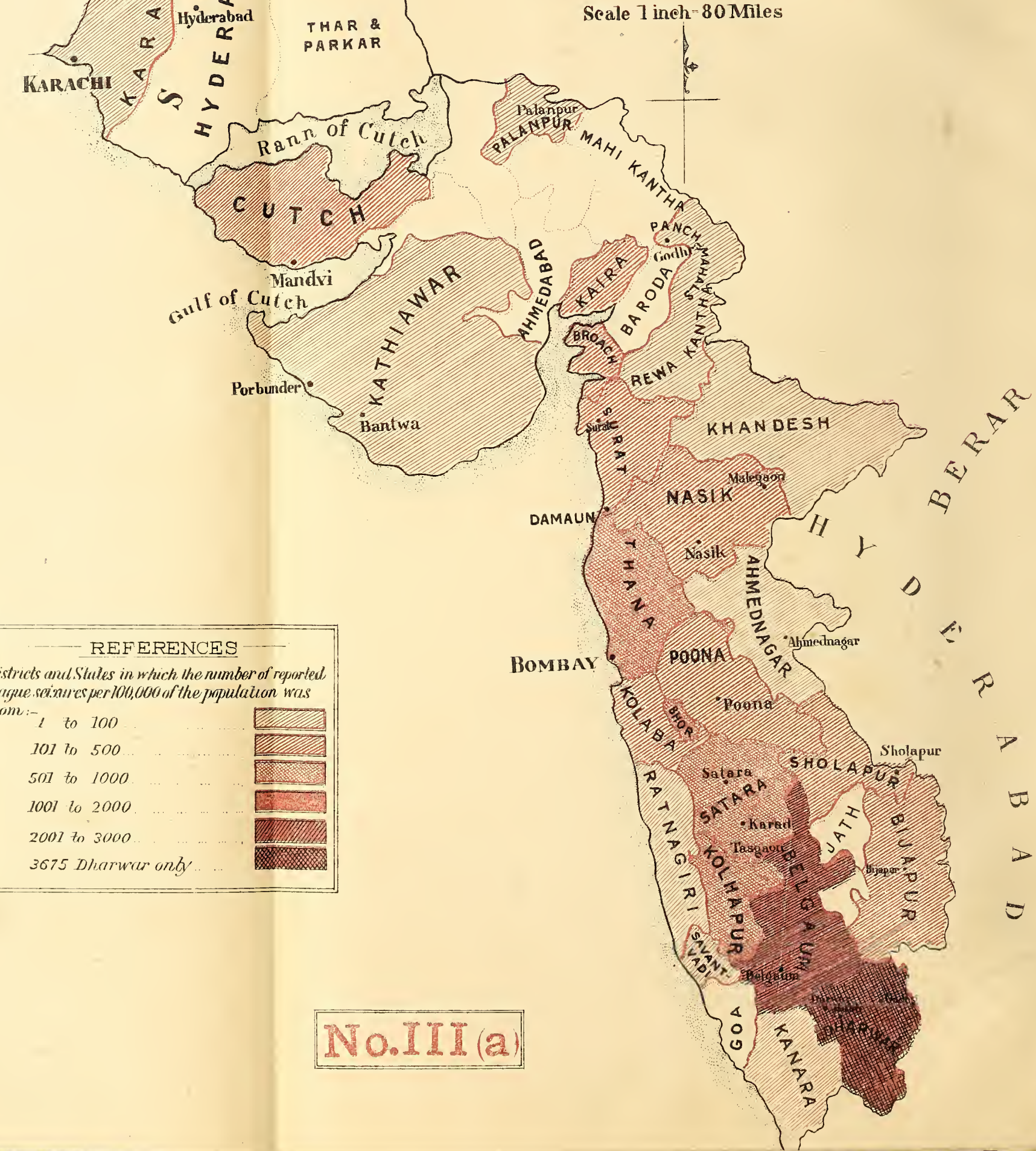
ILLUSTRATING THE EXTENT AND INTENSITY
OF THE PLAGUE

June 1898—June 1899.

Scale 1 inch = 80 Miles

REFERENCES	
<i>Districts and States in which the number of reported plague seizures per 100,000 of the population was from:-</i>	
1 to 100	
101 to 500	
501 to 1000	
1001 to 2000	
2001 to 3000	
3675 Dharwar only	

No.III(a)



So far the outlook was hopeful, but only so far. In some places, contrary to the experience of the first year, fresh epidemics were actually beginning or the figures were actually rising. This was the case in Bhiwandi Town and Belgaum Town and District; in Porebunder and Bantwa Towns in Kathiawar; in Mandvi Town, in Cutch; and in the Bhor and Sachin States.

But it was in the least expected quarters that the heaviest blows were to fall. Up to this time the Ahmedabad, Bijapur, Broach, Dharwar, Kaira, Kanara and Panch Mahals Districts, the Jath State, Thar and Parkar in Sind, and the Upper Sind frontier had practically escaped unscathed. During the year now under review six out of these fortunate ten fell. In June Dharwar, in July Broach, in September Bijapur and Kaira, in October Panch Mahals, in December Kanara, were numbered amongst the infected.

Dharwar excepted, however, none of these newly-infected Districts suffered with peculiar severity: but upon the Dharwar District plague laid a heavy hand. In 8 months—from July 1898 to April 1899—this ill-fated District paid a death-tribute of over 30,000 lives to plague, a mortality greater than the entire plague mortality of the whole Presidency during the first period, as will be seen from the following figures:—

Dharwar District.				Cases.	Deaths.
July 1898 to March 1899	...	...	...	37,805	30,687
Bombay Presidency.					
September 1896 to June 1897	...	...	...	35,434	28,737

It was to be expected that, as was the case during the second year, even in those places which had shaken themselves free from it, plague should re-appear during the third year. This indeed occurred. In Surat District, after a mild epidemic which lasted till November 1898, plague re-appeared in January 1899, though in a mild form, for the weekly figures never reached 100. In the Thana District after a slight lull during May and June it burst out with great virulence in Bhiwandi Town during July, August, and September 1898; and after another slight subsidence which lasted during October, November, and December 1898, it re-appeared in epidemic form throughout the District in January 1899; and for 17 weeks the figures returned from this District exceeded 100 weekly. Ahmednagar, though never seriously affected, continued to have sporadic cases from October 1898 to April 1899. The Khandesh District was re-infected in December 1898, and recorded a mild epidemic which lasted till April 1899. The Nasik District was re-infected in August 1898, and has suffered continuously since. The Poona District, never quite free, recorded a rise in August, which lasted till the end of November 1898; it, too, was never again quite free. The Satara District, since its first infection in July 1897, has never since been free from plague, and from August 1898 to March 1899 suffered from an epidemic of considerable severity; the highest weekly figures being 903 cases and 712 deaths (week ending 4th November 1898); and for 8 months in succession (August 1898 to March 1899 inclusive) returned an average of 250 cases weekly.

The Sholapur District, after being free during May, June, and July 1898, was re-infected in August of that year, and recorded a mild epidemic which lasted till March 1899. The Belgaum District, which saw its first infection in November 1897 and has never since been free from plague, recorded an epidemic of great severity from August 1898 to January 1899; the highest weekly figures being 1,777 cases and 1,303 deaths during the week ending 14th October 1898; every town of importance being badly affected. The Kolaba District remained practically free from May to December 1898; but in December the figures

gradually rose and a mild epidemic, which lasted till May 1899, now took place. The Broach District was slightly affected by two epidemics during this third period.

The total numbers of cases and deaths recorded throughout the Presidency during this Third Period were—

3rd June 1898 to 2nd June 1899.

Cases, 147,748—Deaths, 115,084.

Since the 2nd June 1899 plague has continued and increased, especially in the Poona, Nasik, Belgaum, Satara and Ahmednagar Districts. Dharwar also suffered from a severe recrudescence.

Poona City, which was the cause of great anxiety in the beginning of the year, managed to keep its plague figures down till about the middle of June, when the number of cases and deaths rose with terrible rapidity. This epidemic was exceedingly severe, as, out of a total population of 161,696,—of whom more than half fled—there continued to occur for a month and a half over 1,000 cases weekly; or a case-incidence of about 334 per mille per annum for the whole period. For weeks there were about 1,000 plague patients a day in the General Plague Hospital, the nurses and doctors being excessively hard worked.

During this epidemic a large number of Europeans in Poona were attacked, there being 30 cases—5 deaths from the 2nd June up to November.

In the epidemics in the Nasik, Belgaum, Satara, Ahmednagar, and Dharwar Districts, the places principally affected were Nasik Town, Belgaum Town, Karad, Nagar Town, and Hubli respectively. Towards the latter half of October 1899 plague showed a tendency to decline generally throughout the Presidency.

From the 2nd June 1899 to the 29th September 1899 the numbers recorded have been —

Cases, 60,046—Deaths, 45,637.

The total numbers for the entire three years of plague from :—

23rd September 1896 to 29th September 1899

being

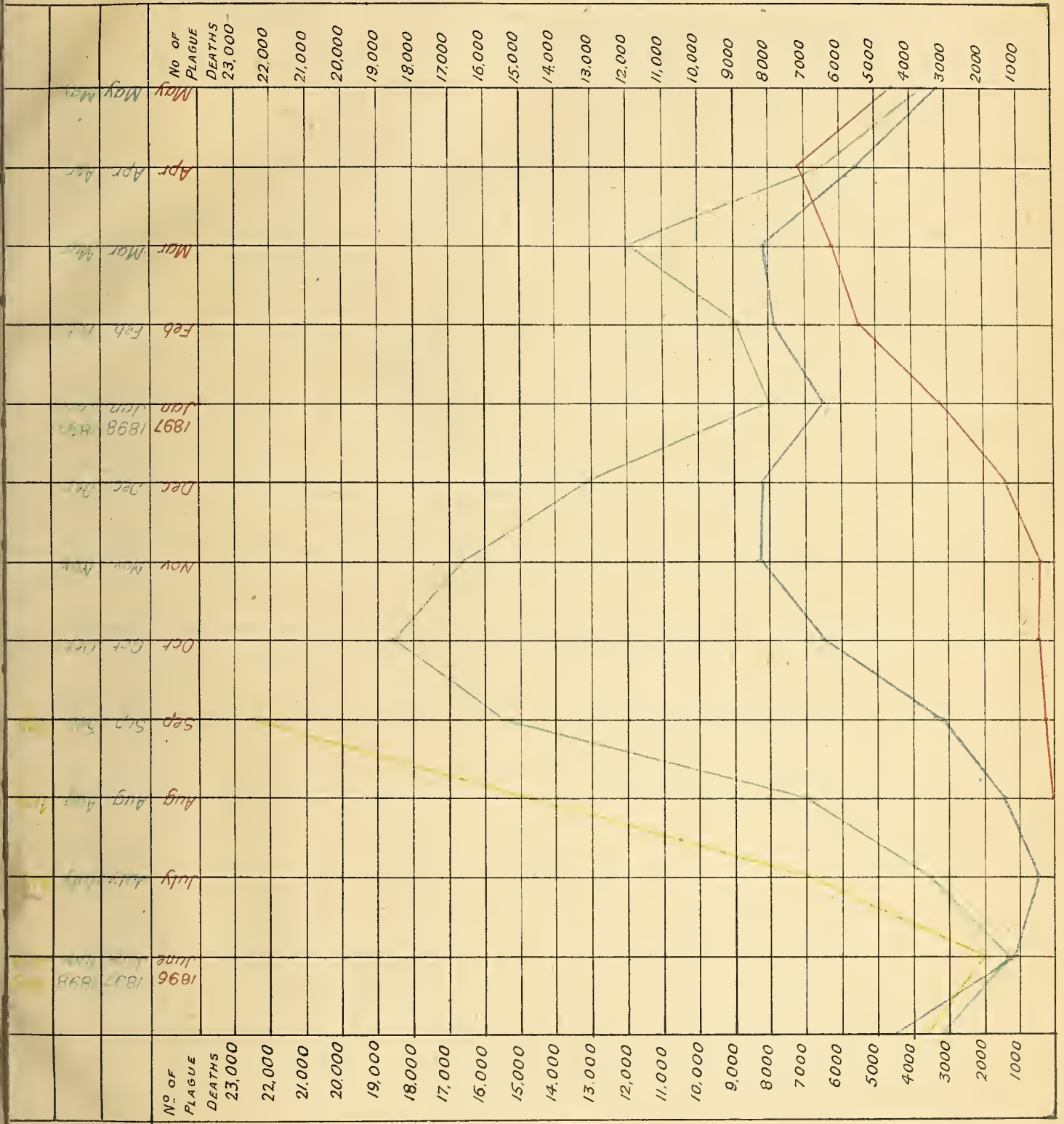
Cases, 319,040—Deaths, 250,677.

Maps Nos. IV and IV (a) show the incidence of plague for the whole period from September 1896 to September 1899: the former including the large Towns; the latter excluding them.

It will be easily seen, that, so far, with the exception of Dharwar, and perhaps also of Belgaum and Satara, the Districts *as a whole* have not suffered severely: that the incidence of plague has been mainly confined to the *large Towns* of the Presidency. In this connection several facts are noteworthy. The plague history of the last three years in this Presidency shows that the infection of a large Town is a source of greater danger to the neighbourhood and a greater factor in the dissemination of plague than the infection of many villages. Thus in Ratnagiri, although several small places were attacked, plague was never bad; so also in Kaira, Kanara and Khandesh. But in Dharwar District, Hubli Gadag and Dharwar spread the infection broadcast: in Satara District, Karad, Tasgaon, and Kaledhon did the same: whilst in Cutch State, Mandvi; in Kolhapur and S. M. C., Sangli Miraj and Shahapur; in Belgaum District, Belgaum and Bail Hongal; and in Thana District, Bhiwandi and Bassein acted as the foci for the radiation of dissemination.

The following statement shows the duration of epidemics in, and the plague figures for, the places which suffered most severely during the Third Period :—

CHART
 Shewing the Monthly
 Progress of Plague
 in the
 Bombay
 Presidency
 from
 Sept. 1896 to Oct. 1899.



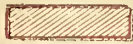





BALUCHISTAN

MAP OF THE BOMBAY PRESIDENCY

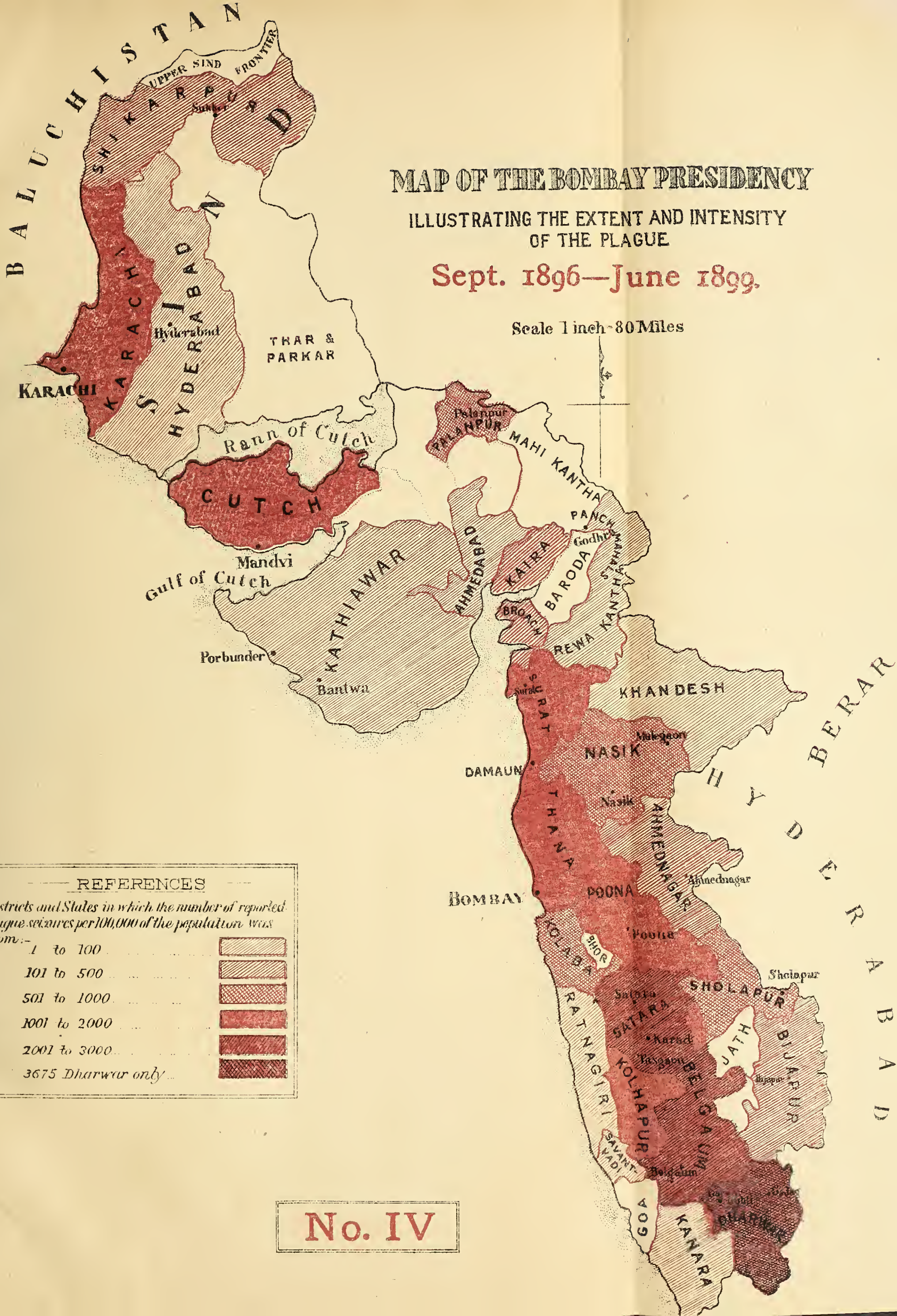
ILLUSTRATING THE EXTENT AND INTENSITY
OF THE PLAGUE

Sept. 1896—June 1899.

Scale 1 inch = 80 Miles

REFERENCES	
<i>Districts and States in which the number of reported plague seizures per 100,000 of the population was from:-</i>	
1 to 100	
101 to 500	
501 to 1000	
1001 to 2000	
2001 to 3000	
3675 Dharwar only	

No. IV



BALUCHISTAN
SHIKARPUR
UPPER SIND FRONTIER
Sukker
KARACHI
HYDERABAD
THAR & PARKAR

MAP OF THE BOMBAY PRESIDENCY

ILLUSTRATING THE EXTENT AND INTENSITY
OF THE PLAGUE

Sept. 1896—June 1899.

Scale 1 inch = 80 Miles

Rann of Cutch
CUTCH
Mandvi
Gulf of Cutch
Porbunder

KATHIAWAR
Bantwa

Palanpur
PALANPUR

MAHI KANTHA
PANCH
Godhr
KATRA
BARODA
REWA KANTHA

KHANDESH
NASIK
Malegaon
Nasik
AHMEDNAGAR
Ahmednagar
BOMBAY
POONA
Poona

KOLABA
RATNAGIRI
SAVANT
VADI
SOLAPUR
Sholapur
JATH
BILAPUR
KARAD
Tasgaon
KOLHAPUR
BELGAUM
Belgaum
KANARA
DARWAD

HYDERABAD
BERAR
A
B
A
D

REFERENCES

Districts and States in which the number of reported
plague seizures per 100,000 of the population was
from:-

1 to 100	
101 to 500	
501 to 1000	
1001 to 2000	
2001 to 3000	
3675 Dharwar only	

No.IV (a)

Explanatory of Map No. IV (a).

TOWNS.

I.—Case incidence ; under 100 per mille. ○

Town.	Population.	Duration of Epidemic.	Cases. Deaths.	Case incidence.
(i) Sholapur	61,564	Oct. 1897—Feb. 1898	$\frac{2351}{2169}$	$\frac{43}{1000}$
(ii) Poona	161,696	Aug. 1897—Mar. 1898	$\frac{10638}{8064}$	$\frac{66}{1000}$
(iii) Hubli	52,194	June 1898—Dec. 1898	$\frac{3579}{3013}$	$\frac{69}{1000}$

II.—Case incidence ; between 100 and 150 per mille. ●

(i) Karachi	97,009	Dec. 1896—July 1897	$\frac{10426}{8103}$	$\frac{107}{1000}$
(ii) Bantwa	8,641	July 1898—Nov. 1898	$\frac{933}{599}$	$\frac{108}{1000}$
(iii) Belgaum	28,342	Aug. 1898—Jan. 1899	$\frac{3260}{2501}$	$\frac{115}{1000}$
(iv) Karad	12,085	July 1897—Nov. 1897	$\frac{1521}{1161}$	$\frac{123}{1000}$

III.—Case incidence ; over 150 per mille. ●

(i) Bhiwandi	14,387	May 1898—Oct. 1898	$\frac{2333}{1741}$	$\frac{162}{1000}$
(ii) Bail Hongal	9,428	Sept. 1898—Jan. 1899	$\frac{1627}{1311}$	$\frac{173}{1000}$
(iii) Cutch Mandvi	38,155	Feb. 1897—Aug. 1897	$\frac{7383}{6082}$	$\frac{194}{1000}$

CHAPTER I.

GENERAL REVIEW.

Part II.—Measures and their Results.

Since plague began in this Presidency in September 1896, no effort has been spared to eradicate it from Bombay City and the other places where it first appeared: to check its dissemination and spread to other places: to prevent reeruption or re-infection in places where outbreaks had occurred and the disease had apparently died out. Hardly any such effort, however, whatever its direction, has been completely successful. Bombay City, Poona, Karachi and many others, have, year after year, in spite of the most strenuous efforts, suffered from epidemic after epidemic; the area of infection, which, extensive as it was at the close of the first year, was yet clearly limited, now practically covers the entire Presidency: Hubli, Dharwar, Satara, Surat, Nasik, Godhra, and many other large towns, in spite of every effort to save them while as yet they were only threatened, suffered from severe outbreaks. Measure after measure has been tried to prevent infection, to minimise dissemination, to check an incipient outbreak—has been tried, and to some extent, at least, found wanting.

The reasons for this want of success may be found in our ignorance of the origin and modes of spread of the disease; in the failure of the people to comprehend its characteristics, and the value of the measures—in the proper enforcement of which their co-operation is essential; and in some measures, perhaps, to the limited scope of the measures themselves. These reasons are supported by the following evidence.

The plague measure hitherto most universally adopted and most uniformly successful has been evacuation, *i. e.*, the desertion of an infected locality by its inhabitants and their transference to another place. There is a great deal of evidence to show that such action has excellent results in reducing the virulence and duration of an outbreak; but the results have been in a great many instances spoiled. As far as is at present known, and as far as present evidence permits of a theory, the infection of plague appears to be an *infection of locality*. That is to say, that a place becomes infected, and *a person stopping in such a place* is in danger of getting plague. If this theory is true, then the good results of evacuation are easily understood, as it removes the people from the sphere of infection.

Where evacuation has been attended with a want of success, therefore, the reason is perhaps to be sought in the return of the people to the infected locality either with or without permission. This is due more to the people's failure to appreciate the danger attending such visits, than to their impatience of a slight temporary inconvenience.

Quite other, again, are the reasons of the powerlessness of Railway Medical Inspection to prevent dissemination: which are, first, the limited scope of this measure, in that it does not affect people travelling by road either by carriage or on foot: and second, that the methods by which plague is spread being unknown, it is necessarily uncertain how far railway inspection affects those methods. The theories on plague dissemination are so many and so various that the measure that would embrace them all would indeed be a far-reaching one. Moreover, in the incubation period, the diagnosis of plague is so difficult as to discount in some degree the value of any inspection, however careful.

And so with other measures. It is needless to enlarge upon them here, as they are each treated in detail in their proper places. Yet, in spite of the lack of *complete* success, a large share of success has undoubtedly crowned the efforts made in many directions to combat the progress of the disease.

The importance of the people's co-operation in plague measures cannot be overrated. In a Town or Village which is determined to protect itself from infection, *every person in such Town or Village becomes a plague authority to prevent the introduction of infection*; a fact to which the Panch Mahals, Broach, and other places which escaped for a long period bear eloquent witness.

In the introduction and enforcing of any plague measure it should be remembered that trade is liable to be affected, the occupations of the people to be seriously interrupted, their prejudices and feelings shocked, and their comfort interfered with. It may be said that hardly any plague measure has yet been introduced which has not had as a result one or more of these undesirable consequences.

In weighing plague measures, therefore (the co-operation of the people themselves being essential to their successful operation), next to their beneficial effects, the extent to which they will hamper trade, interfere with professions and occupations, shock widespread prejudices and still widespread feelings, and produce general discomfort, must be considered.

The considerations affecting the introduction of a plague-measure may be classed as follows:—

- (1) Its feasibility.
- (2) Its beneficial effect and utility.
- (3) Its influence on trade and on the lives, occupations and minds of the people.
- (4) Its expense—costliness.
- (5) The sphere of its effect.
- (6) The duration of its effect.
- (7) The organization required to carry it into effect, and a few other minor considerations.

The value of a measure may be arrived at by an appeal to—

A.—Facts.

B.—The opinions (founded on personal experience) of those who have had a large acquaintance with its operation.

The facts are contained in the statistics of Plague. Unfortunately, a small circumstance will vitiate them, *e. g.*, the natural subsidence of plague having begun before evacuation was started, concealment of the existence of the disease until a great many cases have occurred, false statements made by persons wishing to avoid plague restriction, inexperience, etc., etc. These and many other similar reasons render the attitude of the statistician towards plague figures and statements one of extreme caution; and such an attitude makes confident deduction and reliable results almost impossible. Executive work has, moreover, unfortunately militated against the keeping of reliable detailed records. In such cases, however, the results have left their impressions on the minds of those engaged in carrying out the measure; and these impressions will be noticed later.

The following is a brief sketch of the measures introduced throughout the Presidency from September 1896 to the present time:—

Bombay City, the scene of plague's first appearance in 1896, being at once the seat of Government, the chief commercial and trading port of India, and the Capital of the Presidency, the following points were of the first importance:

(i). *To keep open the trade and commerce of the Port.*—This was done by stiffening the inspection already in force on ships in cases of infectious disease, and making such infection applicable to plague. On the promulgation of the Venice Convention, its terms were strictly enforced, and have been steadily complied with up to the present time. But this question had two aspects. There were vessels going to ports *out of* India and again others to ports *in* India. At first the inspection was confined to vessels bound for certain ports out of India, but when it was found that people were being taken to Indian ports in the immediate vicinity of Bombay, all vessels were examined before leaving the port. This examination was, however, not introduced until after the Bombay Coast ports had become heavily infected.

This inspection of all departures from Bombay which was introduced in February 1897 has not since been relaxed, and its efficacy has been proved by the comparative freedom of the coast ports from plague during the second and third epidemics in the City.

When Bombay was almost free from plague in the hot weather of 1897 the people from the infected ports in its immediate neighbourhood commenced to flock into the City. Medical inspection of all arrivals from these infected ports was carried out with a view to prevent plague travelling by sea and this inspection was relaxed to suit the circumstances prevailing in Bombay itself or at previously infected coast ports.

The success that has attended the efforts to keep open the commerce of the port has been most striking. It is perhaps one of the few bright spots on an otherwise sombre canvas. Notwithstanding the difficulties of diagnosis in the incubation stages of the disease, the number of cases which have been taken by ship from Bombay to ports out of India can be counted on the fingers of one hand. The mischief they have done has been nil: *for in no case did they establish or spread infection.* Too much stress cannot be laid on such a result, when the importance of Bombay City as an Indian sea-port is considered. Details of the working of Sea-inspection during the first year may be found in Nathan and Couchman, and from June 1897 to June 1899 in Chapter V.

(ii). *To prevent its spread in the Presidency and to other parts of India.*—To this end Railway Medical Inspection was introduced as early as October 1896. At first carried out by Civil Surgeons and their Assistants, under arrangements made by Collectors, it was, as far as concerned Bombay and its neighbourhood (Kalyan, Coorla, etc.), placed in January 1897, first in charge of Major (now Lt.-Colonel) Street, I.M.S., and then in that of Captain (now Major) Jennings. Captain Jennings relinquished charge in July 1897, and from that time till November 1898 a system of inspections and detention camps on the railway was in force throughout the Presidency under the superintendence of Collectors, aided by Hospital Assistants. In November 1898 all Detention Camps were abolished; and a new system of Railway Medical Inspection, combined with Surveillance, was introduced; Captain Jennings, with a competent staff of Commissioned and Subordinate officers, being placed in charge.

Although this measure has not prevented dissemination, it may be safely asserted that it has materially lessened it. Details of the working of Railway Medical Inspection during the first year may be found in Nathan and Couchman, and from June 1897 to June 1899 in Chapter VI.

(iii). *To stamp out the disease in Bombay and other places as they became infected.*—In the beginning all such attempts were, owing to the widespread ignorance which prevailed on the subject of plague, its origin and its treatment, necessarily tentative. One of the most important steps taken was the constitution of the Plague Research Committee, whose work in connection with plague was careful and thorough.

As the report of this Committee is given in full in Chapter II. (Medical Aspects of Plague), and its constitution is mentioned both in that Chapter and in Chapter III., Part I., Rise of the Plague Laboratory, it is unnecessary to say more here than that the Laboratory itself was merely a branch of this Committee, and that since its report issued, little, if any, real progress has been made in the medical knowledge and treatment of the disease.

At first on historical grounds, and later because of its marked success when tried, Evacuation, where feasible, became the chief plague measure. It is sufficient to say here that this measure, when prompt and thorough, met with very general success; but its advantages and drawbacks are fully discussed in a subsequent note, and it is widely mentioned in the plague histories of Districts. The next most universal but not so generally successful measure was that of Disinfection; concerning which for many reasons there is little that is satisfactory to say. Several powerful Disinfectants have been used in different places during different epidemics: chief amongst these may be mentioned Corrosive Sublimate (perchloride of mercury), Carbolic Acid, Lysol, Phenyle. The first of these would appear to be of little value in inexperienced hands; and its use is now confined to skilled persons.

The results of Disinfection are inconclusive, and there is perhaps no portion of plague work the records of which are more meagre and less reliable. An attempt was indeed made to collate the results which had been obtained all over the Presidency. Returns were called for in which the exact action taken in regard to each infected house was detailed under certain heads. These returns were sent to the Laboratory, where an endeavour was made to arrive at such conclusions and to draw such deductions from them as seemed permissible. Owing, however, in some cases to paucity of detail, in others to unreliability of record, and in yet others to want of information, no definite results, either good or bad, could be arrived at. This measure has for the above reasons not been separately treated in a note.

Among minor measures the isolation of the plague-stricken, the segregation of contacts, the disinfection of clothes and persons at Camps and Railway stations, certificates of death previous to disposal of bodies, and search parties for the discovery of cases may be noticed. Of these, death certificates and search parties (except in Bombay and Poona City) have been largely abandoned; their utility being incommensurate with their drawbacks and general undesirability, except in very large places.

In the preface, allusion has been made to the *good* results of which the plague has been, either directly or indirectly, the cause. The stringency and severity of most of the plague measures at one time or another introduced, will tend to render the people less sensitive to minor measures which Government may find it necessary from time to time to enforce on other grounds. The devoted labour of so many, voluntarily given to combat the pestilence, has undoubtedly done much to prove to the masses that their sufferings and hardships are both realized and sympathized with: and the close relations between the different races entailed by disinfection, search parties, etc., etc., have, as undoubtedly, thrown down many a barrier of caste and prejudice—destroyed many a misunderstanding of long existence.

Apart, however, from the *ethical* good which has indirectly accrued from this visitation, *material* improvements can be pointed to, which make for both the health and the comfort of the large mass of people. Sanitation has been vigorously carried on, as perhaps never before; and houses unfit for habitation have been razed to the ground.

Nothing enduring can be raised in a day: and seed time and harvest are separated by a time of development and growth. The consideration for, and sympathy with, the people shown by officials and non-officials alike, the generous grant of Discretionary Relief, the

provision of free camps and food in times of evacuation and the many other matters in which the people's welfare and comfort have been considered, are the seeds of which the harvest is not yet.

In conclusion, a general review of the Plague History of this Presidency during the last three years tends to show that although the Presidency has suffered heavily, and that, although the pestilence has spread, neither the general incidence of the disease, nor the actual plague mortality—*except in certain very small places in the rains, when no measures could be effectually enforced*—will bear comparison with the terrible results—the appalling mortality—accredited to the pestilence in the past. And it may fairly be urged that to the various measures so promptly and thoroughly enforced, and to the loyal efforts made in their introduction, and the careful watch kept over their strict observance, by a large and devoted body of plague workers scattered over the entire Presidency—men and women—European and Native—Official and Non-Official—this moderated virulence—this lessened mortality—in other words, *this success in the fight with plague* is due.

CHAPTER I.

Part III.—Evacuation.

Evacuation as a plague measure has not only recommended itself to almost all persons, whether Medical, Civil or Military, who have had any experience of plague, but has been (and is) successively adopted by Governments, as plague has appeared in their territory. In the Government Report of the plague in the Hoshiarpur and Jullundur Districts, this is the measure approved of and relied upon by the Punjab Government*—

“The advantages of evacuation and thorough disinfection of the whole village site have been so accepted, as fully proved, that little argument has been used regarding them in the report. A comparison of the number of cases in Banga, Bhangal Kariha, Garhi and Garhshankar, where immediate evacuation was not insisted on, with that of the later villages, where no delay was allowed to occur, will show clearly the necessity of having all the villagers camped out in the open air at the earliest possible moment.

The argument is this. Plague shows no tendency to spread from house to house unless it is carried by human beings or animals.

Rats take the disease, and it is admitted that after being infected they have no tendency to leave their homes unless they are disturbed, and that in ten days all that live in the infected houses should have died. If, however, they are disturbed by the roofs being at once taken off infected houses, floors being dug up and everything being flooded with Phenyle, they must leave the infected houses and carry the infection to other houses. In front, therefore, of the line of disinfection through a village there must be an advancing wave of infection carried by rats; and when the disinfection reaches the last house in the village, the remaining rats must either double back into the houses already disinfected, thus re-infecting them, or they must leave the village and carry the infection to some other village, and either result is clearly one to be avoided.

The matter may be somewhat ridiculous, but given the premises, the conclusion and therefore the rule would appear to be sound.

The total number of cases have been 3,390.

The total number of deaths 2,103 or about 61 per cent. of attacks. I have had these cases analysed for the purpose of seeing what effect evacuation of the village site had on the disease, and I find from the statements made out, that of the total 3,390 cases—

1,335	occurred before evacuation.
1,014	„ within four days after evacuation.
421	„ within the second period of four days.
169	„ within the third period.
103	„ within the fourth period.
83	„ within the fifth period.

This gives the total cases up to 20 days after evacuation: enquiries were not pursued beyond this period.

The cases which occurred within the first four days after evacuation are cases which must have taken the infection in the village, and which were only discovered as soon as the people came out into camp. Adding these 1,014 cases to those known to have existed before evacuation, it is found that 2,349 cases out of a total of 3,390, or practically two-thirds, are directly due to infection inside the village.

It may be also fairly assumed that many of the cases included in the second period of four days were infected before evacuation, as the ordinary period of incubation is five or six days.

The result of evacuation, as shown by the successive drops from 1,014 to 421, 169, 103 and 88, is most clearly marked. The fall is not to be ascribed in any way to the disease having run its course, since it was proved over and over again that in the evacuated houses in the villages the disease still retained its full virulence.”

Again, in the complete evacuation of Javalapur, a town of some 10,000 souls, close to Hardwar, the North-Western Provinces Government may be seen adopting this same measure in its most complete form.

Evacuation may be :—I.—Complete ; II.—Partial.

I.—*Complete evacuation* is the emptying of the whole town or village infected, without discrimination of infected or non-infected quarters.

II.—*Partial evacuation* is the emptying only of such houses, streets, blocks or quarters as appear to be either infected or within the sphere of probable infection.

* Report on the outbreak of plague in the Jullundur and Hoshiarpur Districts of the Punjab, 1897-98.

(1) *Its feasibility*—

Theoretically speaking, there is no limit to its feasibility, as it is merely the transference of a population from one locality or site to another. But, in practice, many circumstances combine to limit it. Amongst the chief of these are want of space, danger of spread, interference with trade, occupations, etc., etc. Looking at what has actually been accomplished, we find that Jawalapur (10,000), Ahmednagar (37,000), Sholapur (62,000), were all completely evacuated; and a population of 100,000 may perhaps be considered a rough limit of the feasibility of the complete evacuation of a town.

There are, however, but few such towns, and this consideration therefore does not affect the large bulk of towns and villages in the Presidency, which vary in population from 300 to 30,000.

In these, almost without exception, evacuation may be said to be quite feasible.

The statistics of Plague show that complete evacuation—

- (i.) Checks a crescent epidemic.
- (ii.) Lessens plague mortality.
- (iii.) Shortens the duration of an epidemic.
- (iv.) Tends to arrest the disease *in toto* in villages if carried out at once.

Taking first—

A.—Facts.(i.) *Evacuation checks a crescent epidemic.*

Instances of this in large towns are Sholapur, Nasik, Jalgaon, Malegaon, and Godhra; whilst amongst villages the number is very large.

The following table shows the progress of the disease before, during, and after evacuation at Jalgaon, Malegaon, Nasik, Sholapur and Godhra:—

Week ending	JALGAON (POPULATION, 14,672).		MALEGAON (POPULATION, 15,633).		NASIK (POPULATION, 24,406).		SHOLAPUR (POPULATION, 61,564).		GODHRA ¶ (POPULATION, 14,691).		
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	
1897.											
October 1st	
" 8th	19	13	...	...
" 15th	3	3	26	8	...	...
" 22nd	11	9	50	45	...	...
" 29th	11	11	116	90	...	...
November 5th	12	10	146	117	...	...
" 12th	*3	...	143	118	...	...
" 19th	9	6	+ 68	35	221	182	...	...
" 26th	7	5	+ 31	36	363	297	...	...
December 3rd	...	§ 20	15	4	+ 33	26	* 502	377	* 3	2	
" 10th	...	* 7	4	21	+ 26	23	+ 501	436	+ 10	5	
" 17th	...	+ 32	30	19	+ 40	30	+ 300	246	+ 27	22	
" 24th	...	17	10	24	+ 43	34	+ 134	149	+ 18	10	
" 31st	...	10	8	26	+ 44	34	+ 53	36	+ 28	19	
1898.											
January 7th	...	14	17	* 63	48	+ 49	45	26	27	+ 41	26
" 14th	...	11	7	+ 78	62	32	32	9	9	+ 45	29
" 21st	...	14	12	+150	41	18	12	7	11	+ 59	50
" 28th	...	8	8	+129	27	7	9	5	8	+107	64
February 4th	...	2	1	+ 27	20	5	3	1	2	+106	79
" 11th	...	1	2	12	13	5	5	9	8	+125	108
" 18th	...	1	1	10	9	4	3	2	4	+137	78
" 25th	11	9	4	4	6	4	28	22	...
March 4th	...	1	1	2	4	3	1	...	2	13	11
" 11th	4	3	6	5	2	3
" 18th	1	...	8	3
" 25th	3	2	1	...	2	...
April 1st	1	1	1

1899. (Godhra only.) 1898.

* Evacuation begun.

† Evacuation rapidly proceeding.

‡ Evacuation complete.

§ The Collector estimates that some 20 deaths from plague at least must have occurred up to this date.

¶ A day's difference in the dates owing to difference of year.

1899. (Godhra only.) 1898.

In each of the above cases the Collector unhesitatingly attributes the sudden subsidence of the epidemic to the direct action of evacuation; an action directly proportionate to the promptness and rapidity with which it is carried out.

As regards—

(ii.) *Evacuation lessens plague mortality.*

The following statements show the percentage of plague deaths on population in evacuated and non-evacuated towns :—

(a) *Evacuated Towns.*

Towns.	Population.	Cases.	Deaths.	DURATION OF EPIDEMIC.		Percentage of deaths to population.	REMARKS.
				From	To		
Surat	108,631	2,621	1,834	1st August 1897 ...	1st May 1898 ...	1·67	
Sholápur * ...	61,564	2,639	2,187	1st October 1897 ...	1st February 1898 ...	3·5	
Broach ...	40,137	622	514	1st December 1898 ..	1st April 1899 ..	1·03	
Ahmednagar ...	36,031	326	272	20th November 1897..	1st April 1898 ...	·75	
Satara ...	25,748	720	612	1st December 1897 ..	1st April 1898 ...	2·00	
Násik ...	24,406	461	369	1st October 1897 ...	1st April 1898 ...	1·51	
Gadag ...	23,321	395	254	18th November 1898.	24th February 1898 ..	1·03	
Málegaon ...	15,633	395	314	1st November 1897...	1st April 1898 ...	1·63	
Godhra * ...	14,691	761	538	1st December 1898...	1st March 1899 ...	3·66	
Jalgaon ...	14,672	118	108	1st December 1897 ...	1st February 1898 ...	·73	
Ilkal ...	11,216	284	238	15th September 1898.	18th November 1898	2·00	
Ashta	11,412	135	112	1st February 1899 ...	19th May 1898 ...	·98	
Ankleshwar ...	10,692	322	238	15th July 1898 ...	1st October 1898 ...	2·22	
Average ...						1·75	

* Sholápur and Godhra were not evacuated until the mortality had been very severe.

(b) *Non-evacuated Towns.*

Towns.	Population.	Cases.	Deaths.	DURATION OF EPIDEMIC.		Percentage of deaths to population.	REMARKS
				From	To		
Hubli ...	52,194	3,486	2,957	1st June 1898 ...	1st December 1898...	5·62	
Dhárwár ...	32,583	1,179	374	1st August 1898 ...	1st January 1899 ..	2·99	
Belgaum ...	28,342	3,213	2,413	1st July 1898 ...	1st January 1899 ...	8·51	
Bulsar...	14,714	943	739	1st February 1897 ...	1st June 1897 ...	5·10	
Bhiwandi ...	14,387	546	452	1st January 1897 ...	1st May 1897 ...	3·14	
Karád..	12,085	1,789	1,289	15th April 1898 ...	7th October 1898 ...	8·95	
		1,518	1,154	1st July 1897 ...	1st December 1897...	9·54	
Bassein ...	11,291	497	377	1st February 1897 ...	1st June 1897 ...	3·33	
		356	283	10th December 1897..	1st August 1896 ...	2·50	
		345	304	1st November 1898..	1st April 99 ...	2·69	
Tasgaon ...	11,251	535	453	13th September 1897.	1st January 1898 ...	4·02	
Bail Hongal	9,428	1,627	1,011	26th August 1898 ...	15th December 1898...	13·78	
Bantwa ...	8,641	933	599	1st August 1898 ...	1st November 1898...	7·34	
Average ...						5·95	

On a population of 10,000, therefore, the mortality, according to these averages, would be—

Evacuated town of 10,000	...	...	.. = 175
Non-evacuated	..	...	... = 595

or on a population of a million, a difference of some 40,000 lives.

As regards—

(iii.) *Evacuation shortens the duration of an epidemic.*

Taking District by District, the average actual duration of epidemics in evacuated and non-evacuated towns and villages is given below.* They are classified as follows:—

- (a) Evacuated towns.
- (b) Non-evacuated towns.
- (c) Evacuated villages.
- (d) Non-evacuated villages.

In cases (b) and (d) are included also partially-evacuated towns and villages, so that the figures for them obtain whatever benefit this measure may have bestowed. Bombay, Karáchi, Poona and Surat, also, on account of their size, have been omitted from the following calculations.

For (a) and (b) the results are as follows:—

(a)			
Number of epidemics in evacuated towns...	...	...	= 12
Total aggregate duration of epidemics	...	...	= 184 weeks.
Average duration	...	...	= $15\frac{1}{4}$ weeks.

(b)			
Number of epidemics in towns not evacuated	...	...	= 13
Total aggregate duration of epidemics	...	...	= 266 weeks.
Average duration	...	...	= $20\frac{2}{3}$ weeks.

Evacuation, therefore, would appear to shorten the duration of epidemics in towns by one-quarter.

For (c) and (d), taking District by District, the results are as follows:—

1. *Belgaum.*

(c) {	Villages evacuated	= 15	(d) {	Villages not evacuated	= 13
	Aggregate duration	= 90 weeks.		Aggregate duration	= 150 weeks.
	Average duration	= 6 weeks.		Average duration	= $11\frac{2}{3}$ weeks.

2. *Cutch.*

(c) {	Villages evacuated	= 8	(d) {	Villages not evacuated	= 24
	Aggregate duration	= 54 weeks.		Aggregate duration	= 262 weeks.
	Average duration	= $6\frac{3}{4}$ weeks.		Average duration	= $10\frac{1}{2}$ weeks.

3. *Dhárwár.*

(c) {	Villages evacuated	= 22	(d) {	Villages not evacuated	= 18
	Aggregate duration	= 96 weeks		Aggregate duration	= 203 weeks.
	Average duration	= $4\frac{4}{11}$ weeks.		Average duration	= $11\frac{5}{8}$ weeks.

* Epidemics of under four weeks have been neglected. Only towns and villages in which evacuation was begun within a month after the first case, and for which the figures are reliable, have been taken.

4. *Káthiawár.*

(c) {	Villages evacuated	= 3	(d) {	Villages not evacuated	= 3
	Aggregate duration	= 16 weeks.		Aggregate duration	= 35 weeks.
	Average duration	= $5\frac{1}{3}$ weeks.		Average duration	= $11\frac{2}{3}$ weeks.

5. *Ratnágiri.*

(c) {	Villages evacuated	= 3	(d) {	Villages not evacuated	= 1
	Aggregate duration	= 19 weeks.		Aggregate duration	= 9 weeks.
	Average duration	= $6\frac{1}{3}$ weeks.		Average duration	= 9 weeks.

6. *Surat.*

(c) {	Villages evacuated	= 23	(d) {	Villages not evacuated	= 16
	Aggregate duration	= 133 weeks.		Aggregate duration	= 183 weeks.
	Average duration...	= $5\frac{13}{22}$ weeks.		Average duration	= $11\frac{7}{16}$ weeks.

7. *Thána.*

(c) {	Villages evacuated	= 20	(d) {	Villages not evacuated	= 22
	Aggregate duration	= 123 weeks.		Aggregate duration	= 236 weeks.
	Average duration	= $6\frac{3}{10}$ weeks.		Average duration	= $10\frac{8}{11}$ weeks.

The general result, as shown by these 8 Districts, is as follows :—

<i>Evacuated Villages.</i>			<i>Non-evacuated Villages.</i>		
(c) {	Total aggregate duration	= 531 weeks.	(d) {	Total aggregate duration	= 1,078 weeks.
	Number of villages ...	= 94		Number of villages ...	= 97
	Average duration per village	= about $5\frac{1}{2}$ weeks.		Average duration per village	= about 11 weeks.

Or, in other words, in villages with a population of from 100 to 7,000, evacuation shortens the duration of an epidemic by one-half.

The following interesting table of the effect of evacuation on the duration of epidemic in the villages of Palánpur State is given by Lt. Rainier, I. M. S. :—

	Population.	Cases.	Deaths.	Mortality per cent. of cases.	Case incidence per mille.	Average duration (first to last case in days).	Number of Villages.
Palánpur Town ...	21,092	674	413	61.2	31.9	15.3	1
Total villages, excluding Palánpur.	57,934	953	656	66.8	15.5	31.3	53
Villages not immediately evacuated.	36,301	616	454	73.7	1.60	46.6	22
Villages immediately evacuated ...	2,1633	337	202	59.9	15.0	14.1	31

As regards—

(iv.) *Evacuation tends to arrest the disease in toto in villages when carried out at once.*

The following instances, where no case was reported subsequent to the completion of evacuation, may be quoted. There are others, but the details are not to hand :—

I.

Major Ross writes from Poona :—

"The effect of health-camping was almost magical. Of upwards of 4,000 people taken from the worst infected areas, only one undoubted plague case* occurred after they had returned to their houses; in that instance the woman who was attacked was only six days in Camp, and was taken ill the evening of the day she left."

II.

Colonel Fawcett, R.A.M.C., writes from the same place :—

"Owing to the prevalence of plague in the Wanowrie Bazaar a second Health Camp was established early in December, about 200 paces from that bazaar. It was capable of containing about 400 people, and was arranged and managed in a similar manner to the Camp at the Lall Bagh. As soon as possible after it was ready, the whole of the inhabitants of the Wanowrie Bazaar were moved into Camp. Plague had been rife among these people, and the course of the epidemic was but little modified by the removal of the sick and segregation of contacts. From the date of the removal of the last family to Camp, not a single indigenous case arose among these people, nor did one occur among them after their return to the bazaar.

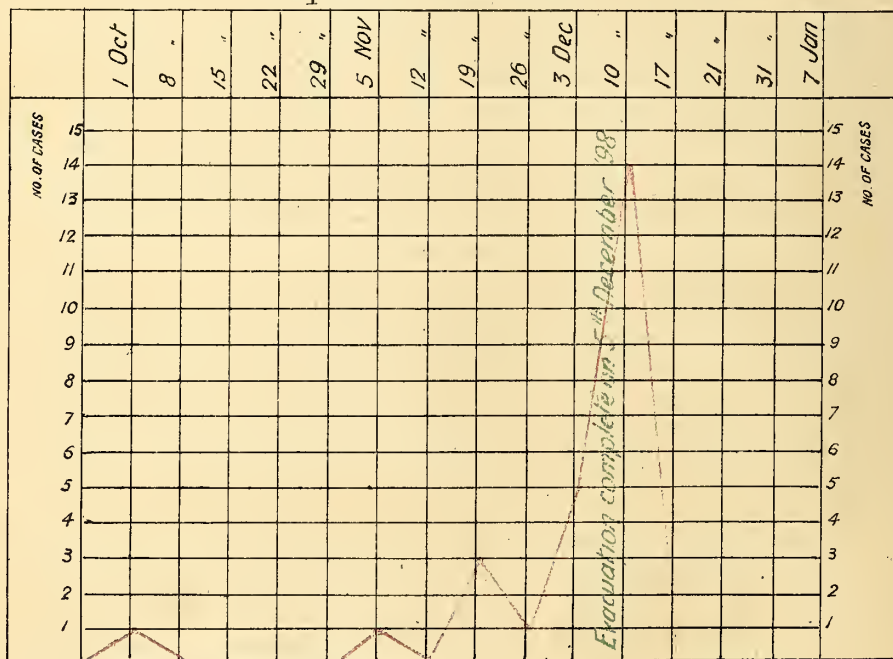
"It may be well to relate an incident that, at the time, made a profound impression both on plague-workers and on the surrounding people.

"When the bazaar people were sent to the Health Camp a small row of huts was overlooked and the inmates left undisturbed. Amongst these (*i. e.*, those who had been thus left behind in their houses) 5 cases, 3 fatal, occurred within 24 hours; the remainder were then segregated without delay. This object-lesson proved of great value, and was not forgotten by the people."

III.

In the District of Khandesh is a village of some 300 souls called Kanawadi. The first case of plague in this village occurred on the 5th October 1897. It was imported. No more cases occurred till the week ending 4th November 1897. During this week one indigenous case occurred. During the week ending 18th November 3 cases occurred, and the following week one case. The epidemic now mounted rapidly: for during the week ending 2nd December there were 5 cases, and during the week ending 9th December 14 cases. The village was emptied on the 5th December, and from the 9th December plague absolutely ceased, for there was not another case. The following chart shows the gradual increase and sudden cessation :—

CHART OF EPIDEMIC IN KANASWADI
Population about 300



* This was the only case subsequent to evacuation.

IV.

The Acting Commissioner in Sind reports:—

"Gharibabad was the worst infected corner of New Sukkur, accounting for 106 cases of plague in the three weeks ending the 19th April. On the 15th there had been 6 cases, on the 16th 6 cases, but on the 17th Mr. Lucas encircled them with a cordon of men of the Wiltshires, and quietly removed the entire population of nearly 600 to the Health Camps, where next day all were disinfected. Not another case occurred. The Camp inhabitants were free to go about their business as usual, but most worked at their trades in the Camp. There was individual medical inspection twice daily."

V.

He continues—

"Limji Charhi was another plague-infected quarter of small size, but giving 4 or 5 cases daily among only some 300 people. On the 26th April they were similarly moved and disinfected. The plague disappeared from that day."

VI.

The Collector of Surat reports:—*

"Asnabad—7 cases occurred between 16th and 26th February 1898. The result of evacuation was successful as the occurrence of cases stopped after it. The village was re-occupied on 11th April 1898."

Other instances are Sukhpur and Mangra in Cutch, and Desur and Tamalwari in Belgaum, besides many others in other Districts.

It will be observed that in the case of evacuated towns, the disease appears to linger on for weeks in a very slight form. This is due to the difficulty, after the people have been turned out of a town or village, of preventing them surreptitiously visiting their houses; and the fact that it has been found to be an almost universal practice unfortunately vitiates to some extent both the actual benefit of evacuation, and the figures of the epidemic of such town or village, by making the duration longer and the figures larger than they would otherwise be.

The following instances illustrate the great risk people run who thus return to their houses, even for the shortest space of time:—†

I.

Major Hyde Cates, Political Agent, Cutch, reports:—

"The village of Luni was evacuated in December (1897) and in the end of January (1898) 4 persons of the village, with 3 relations, visited their houses without permission. *All of them got plague and four of them died.*"

II.

Mr. G. W. Hatch, I. C. S., Assistant Collector, Khandesh, reports the case of a Bannia who returned to his house to get his money: sleeping on it for one night and taking it with him to the Camp the next day. He was attacked with plague the day after his return to Camp, and succumbed.

III.

In Kalol (Panch Mahals District) a tailor, by name Nansukh Narian, hearing that the floors of the houses were to be dug up by the disinfecting parties, and afraid for his money, went to his house secretly and remained in it all night, returning to the Camp the next morning with his rupees. Two days later he died of plague.‡

IV.

Mr. H. F. Silcock, Acting Commissioner, N. D., late Collector of Nasik, writes—

"... it was a matter of common report in the Nasik District that the occasional cases which occurred in Health Camps after evacuation were owing to the people stealing into their houses at night to look after their property. There was one case at Malegaon reported to me, where a Momin weaver, who had been for some time resident in the Health Camp, suddenly developed plague, and it was found that he had been to his house in the town."

* Collector of Surat's No. ^{B. P.} 1256 of 27th November 1899.

† Memorandum No. 57 of 12th January 1899.

‡ Cited in Kalol Māmlatdār's report under Collector of Panch Mahāls' No. 172 of 18th January 1899; and No. Police—1 of 12th January 1899.

V.

He continues—

“At Trimbak in the Nasik District I had one well-authenticated case. The town had been wholly evacuated for some time, but the servants of the Trimbakeshwar temple were very reluctant to leave, but eventually did so. They had been camped out for some ten days or a fortnight, and were quite free from illness, when two of them suddenly developed symptoms of plague; and on enquiry I found that they had surreptitiously entered the granary of the temple a night or two previously, and had removed some grain to their Camp. Only the men who had entered the granary suffered, showing apparently that it was the building and not the grain which was infected.”

But these are but minor instances: and the cases now to be cited show that the increase of the danger is in proportion to the number of people that return thus to an evacuated and infected Town:—

VI.

The epidemic in Surat City (*September 1897—April 1898*) was dying out in February 1898 when the compelled return of the people to the city revived it. The following is the Collector's report:—*

“The end seemed within sight when unexpectedly a cyclonic downfall of rain—most unusual at the season—occurred throughout the district on the 9th February 1898. The immediate and necessary result was the return of all the persons camped outside the city and the villages to their houses. The ill-effects of this move were shown in the increased mortality of the next and following weeks.”

VII.

It was the same in Palánpur Town; for Lt. Rainier, I. M. S., reports:—†

“Unfortunately the occurrence of the Diwali Festival caused a great number of people to return to the town: resulting in a rapid increase of the disease.”

VIII.

So at Kaládgi:—‡

“As regards our one outbreak in Kaládgi, we learnt that evacuation of houses promptly was the best method of prevention: infection to those living in the fields did not extend beyond 10 days after evacuation; and in two cases people returning to sleep in their houses were infected by plague and died. The people were kept in their fields over two months, and no cases have occurred since re-occupation.”

IX.

Similarly in Cutch-Mandvi:—§

“When the cases rose suddenly to 44 in the first week in May the people began to turn out in large numbers, and by the middle of May there could not have been more than 4,000 to 5,000 people left in the town out of a population of between 35,000 and 40,000. The majority remaining in were weavers who have their looms in their houses and the Mahomedans of all classes. A certain number of these latter were also got out ultimately, and the Darbár assisted them to the extent of distributing Rs. 1,200 amongst the poorest of them. No sooner, however, had we got some of the Mahomedans out than a heavy storm came on, and they at once bolted back to their houses, with the result that latterly the Mahomedan quarter was attacked and they kept the plague going.”

X.

So at Porbandar:—¶

“Plague broke out in Porbandar Town in May 1898 amongst the Khárwás. The isolation of the Khárwás proving ineffectual, the complete evacuation of the town was decided on, and carried out by the 25th May. Between this date and the 12th June only 4 cases occurred. Unfortunately on the 11th June the monsoon burst and the people had to be permitted to return to their houses. This re-occupation was followed by a severe outbreak amongst the Khárwás, which spread so rapidly, that, after arrangements for water-tight accommodation had been made, complete evacuation was again insisted on.”

* No. B. P. of $\frac{26\text{th}}{3655}$ $\frac{28\text{th}}{28}$ May 1898.

† Letter No. 488 of 23rd June 1898 from the Superintendent, Land Records and Agriculture, S. D., to the Collector of Bijapur.

‡ Lt. Rainier's report No. 74-B of 9th May 1898.

§ Political Agent's Annual Report for 1897-98.

¶ Political Agent. Kathiawar's No. 408 of 25th April 1899.

These results may be compared thus :—

Locality.	Population.	Period.	Number of Cases.	REMARKS.
Outside the town *	35,000	4 months ...	206	Excluding Salaya.
Inside the town	5,000	4 months ...	421	
Salaya ... ..	... ..	2½ months ...	104	

* Includes houses outside the town.

In other words, a *population* INSIDE the town of 5,000 had more than double the number of the cases of a population seven times as large OUTSIDE the town.

It must be remembered also that the figures for those outside the town include those for all the houses outside the town, and for all such people as paid undetected visits to the town and afterwards displayed plague symptoms in Camp.

B.—*Opinions.*

Those who have had a large experience of plague measures and their results, whether Europeans or Natives, whether Civil, Medical, Military, or unofficial, are practically unanimous as to the value and efficacy of evacuation: even the people themselves, as represented by the more influential of them, who have actually done plague work, and by those again who have learnt the lessons from previous epidemics, show, both by words and actions, that their belief in the value of evacuation is as strong as that of the other classes above mentioned.

Although such evidence is in many cases unsupported by figures, still it carries its own weight in the fact that it is the result of what these people have seen for themselves: not in one or two parts of the Presidency only, but in every locality and every quarter of it.

An occasional dissentient voice is heard, *e. g.*, Mr. V. A. Patwardhan's, from Poona:—

“Wholesale evacuation is highly objectionable, especially in the monsoon and cold weather. If the persons who come into contact with the sick persons leave the house, that is quite sufficient.”

Mr. B. C. Sathé's, from the same place:—

“People showed great aversion to leaving their houses. The chief causes of this were:—

1. Want of safety as regards property left at home.
2. Danger of living in far-off lonely places, especially with children and females.
3. Want of sufficient money to make the habitations in open plains as comfortable as are suited to the habits of the people.
4. In the case of the poor classes living on daily labour, the distant residence told very much on their gains.”

And perhaps Ráo Bahádur B. R. Heblikar's from Sátára, Assistant Surgeon J. V. Mascarenhas' from Dhárwár, and one or two others.

(3) *Influence of evacuation on trade, and on the lives, occupations, and minds of the people—*

As evacuation is nothing more or less than “camping out” for a few weeks, it does not in small villages affect to any considerable extent the large majority of the inhabitants, who are probably peasants, or do peasants' work of one kind or another. It inconveniences the weavers, bannias, shop-keepers, and such classes as under ordinary circumstances never leave their houses. But this is no great matter, as the shops and trade are small, and in most cases can be continued just as well outside as inside the village.

In the case of large towns, however, matters are different, and a larger and larger number of well-to-do inhabitants find their business seriously interfered with by this enforced abandonment of their houses. The larger the town and population the more acutely is the inconvenience felt: until in very large towns, such as Karáchi, Poona, etc., it becomes practically impossible.

The sanctioning of caste camps and hospitals did away with objections on such grounds as caste and rank: and the enforcement of the measure does not now affect the minds of the people. This is shown by the attitude of the people themselves: for, considering the universality of its adoption, complaints have been exceedingly rare.

But these drawbacks will be noticed later on.

(4) and (7).—*Cost of Evacuation.*—

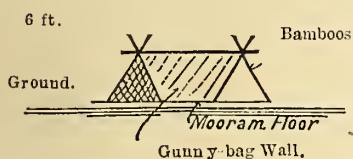
The cost of evacuation varies with the class of people to be turned out.

As a rule, its cost is now nominal, the people being simply told to make their own arrangements, and, except in the case of the very poor, to build their own huts, or erect their own sheds, outside the town.

The cost, again, must be in some sort proportionate to the size of the town, and in the case of a large town like Sholapur, doubtless the expense is considerable. In Jalgaon, however, a town of some 14,000, the expense was nominal: and Major Anderson, I. M. S., states that in Dharwar District the expense was practically *nil*.*

The following note by Mr. Morison,† formerly Collector there, shows the actual cost at Sholapur, where arrangements were made to house everybody. The estimates which follow are, however, very rough; and they merely indicate what has actually been achieved. They are obviously unsuited, not to say impracticable, in the rains, and the accommodation provided in the smaller and cheaper huts was, to say the least, scanty:—

“For housing the people our unit was a triangular shelter (as per margin), made of gunny bags stretched over bamboos, open at front, closed at back, floor area 8' × 8', giving accommodation to a family of 5.



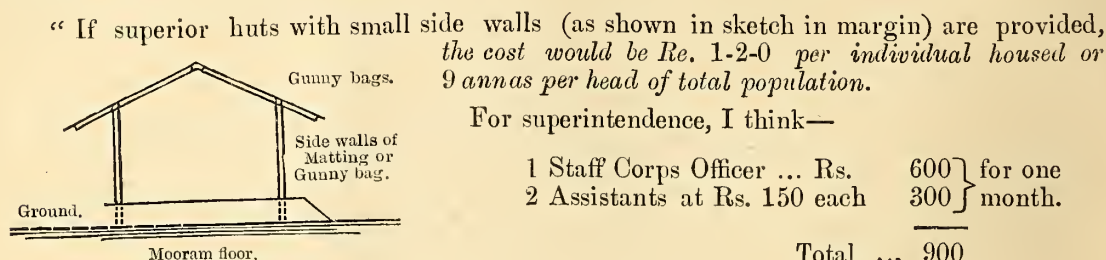
<i>Cost of each shelter.</i>	Rs. a. p.	
10 gunny bags at Rs. 18 per 100 ...	1	13 0
10 bamboos at Rs. 8 per 100 ...	0	13 0
Mooram floor, 6 in. high ...	0	4 0
Serving establishment and sundries ...	0	6 0
Total ...	3	4 0

“Suppose a town of 60,000 is to be evacuated; of the total population at least 30,000 will either run away or erect their own huts and shelters, if sites are given them and proper arrangements made for police protection, etc., the cost of hutting the remaining 30,000 will be—

6,000 huts at Rs. 3-4-0 each ...	Rs. 19,500
Twelve latrine enclosures for males and females with trenches at Rs. 200 each ...	2,400
Water-supply ...	2,000
Huts for police guards, etc. ...	1,000
Total...	Rs. 24,900

* Report on the Navalgund and Nargund Talukas in his charge.
† Letter dated 3rd March 1899.

i.e., a rate of 13 annas per individual housed or $6\frac{1}{2}$ annas per head of total population for the actual hutting, presuming that open ground is available free of charge for camps. No provision is made for shops, bazárs, etc., as the people arrange these themselves if sites are pointed out.



would suffice for evacuating a town of 20,000 inhabitants. I mean for the arrangement of camps in connection with evacuation.

“ In brief, my estimate is as follows :—

Per 1,000 of total population.

<i>Inferior huts.</i>	<i>Superior huts.</i>
Rs. 406, say Rs. 425.	Rs. 562, say Rs. 600.
Plus Rs. 900 for each 20,000 of total population.”	

The maximum and minimum cost of evacuating a town of, say, 20,000, may then be roughly estimated as follows :—

Maximum.

Shed for complete population at 13 annas per head, deducting half population for flight, private arrangements, etc. ...	Rs. 8,100 roughly.
Staff Corps Officer and Staff	900
Say ...	Rs. 9,000

Minimum.

Sheds for 750 indigents (the rest making their own arrangements)	Rs. 304 roughly.
Staff Corps Officer and Staff	900
Say ...	Rs. 1,250

This cannot be considered, due regard being had to the population, an expensive measure.

It must be remembered, however, that these calculations are made for suitable conditions, and could not apply in the monsoon and rainy season.

Nor does it require a special staff or organization ; for it can be carried out in villages and small towns by the village officials on the spot ; and, as in every other measure, much will depend on their trustworthiness. In large towns a small staff of police, with a responsible officer of some standing, is necessary : but such towns are few.

The real difficulty lies in the maintenance of strict segregation after the people have vacated the town, the prevention of clandestine visits to the empty houses, and the flight to neighbouring villages.

For the effective adoption of such measures some responsible and trustworthy officer (with a competent and vigilant police force) is necessary.

But in this connection there is a hopeful sign in the gradual comprehension by the people of uninfected villages and towns themselves, who are at length beginning to realize their own danger in harbouring such fugitives, and consequently to deny to such fugitives entrance into their towns and villages. On the intelligent co-operation of the people, then, depends to a very large extent the necessity for Government organizations to prevent dissemination in the manner just described; and it is hoped that this co-operation will become ever more efficient and valuable as the masses comprehend the salient characteristics of the disease.

(5) and (6).—*The sphere of evacuation; and the duration of its effect.*—

The sphere of evacuation is only limited by the size and population of the town or village emptied; and extends, moreover, not merely to the protection of such population, but to the complete eradication of infection in the village itself: provided that the measure has been allowed sufficient time to do its work.

The duration of its effect, though uncertain, appears to be more or less permanent; the cases where a town or village, which has once been completely evacuated for a sufficient length of time, has afterwards suffered from a *recrudescence*—as distinguished from a *re-infection*—if any such exist, being exceedingly rare.

The disadvantages and drawbacks attributed to evacuation are:—

- (i.) Danger to person and property from dacoity.
- (ii.) Injury to health from exposure.
- (iii.) Impossibility of efficient death registration.
- (iv.) The hardships it imposes on certain of the poorer classes.

Careful inquiries have been instituted on the first two points, with the following result:—

(i.) *Evacuation and Crime.*

That the vacating of a town leaves the houses empty, and increases the risk of robbery, cannot be denied. This difficulty has been partially met by police guards and patrols, and by carefully securing the doors so as to prevent ingress except by force.

Dacoities on the people in the fields also occur, but are not numerous, and seldom serious. From reports received by Collectors it would seem, therefore, that the complete evacuation of villages does to a small extent in some districts tend to increase dacoity and robbery. In other districts, on the other hand, the increase is insignificant. Ahmednagar may be cited as an instance of such a district, and Mr. C. Hudson, I. C. S., the Collector, submits an interesting report on the point:—*

“The following offences were committed during the years 1897 and 1898 in this district at places which were evacuated on account of plague:—

Dacoity	...	...	...	...	...	...	...	...	1
Robbery	...	...	...	...	...	...	...	...	2
House-breaking thefts	...	...	...	...	...	...	...	...	18
Simple thefts	...	...	...	...	...	...	...	...	7
Receiving stolen property	...	...	...	...	...	...	...	...	3
									—
									31

2. The cases were distributed over Nagar City and the villages of Bhingar, Savedi, Máliváda, Shrigonda, and Rájur. Nineteen cases were disposed of by being brought to trial,

* No. 968 of 1st February 1899.

8 were classed as not brought to trial, and 4 were excluded. The total value of the property stolen amounted to Rs. 38,700, of which property valued at Rs. 27,321 was recovered, Rs. 15,000 being in promissory notes.

3. The period under report was a bad one for crime ; and the dacoity was Bala Pichad's first venture, and probably had no connection with plague. There is nothing in the figures to show that offences against property accompanied by violence took place more frequently in consequence of plague measures, though the evacuation of villages is in certain localities followed by an increase of house-breaking and theft."

As regards Bijápúr District, Mr. Bagnell, the Collector, reports :—*

"Offences against property and person were committed in 8 villages, all in the Hungund Taluka, which were vacated owing to the presence of plague there. The thefts were of a petty character, except in 5 cases out of the 16 that occurred in these villages. The value of the property stolen in the 5 cases varied from Rs. 325 to Rs. 100. In Sulebhávi, one of the villages invaded by the offenders, a body of dacoits attacked a man living in a hut and beat him, his brother, and servants with sticks and axes. The man died soon after from the effects of the wounds. The offenders have been arrested, but the police, who were on patrol on the night of the offence, appear to have been negligent in their watch."

Mr. Pratt, Collector of Sholápur, reports strongly on the opportunities for dacoities and theft afforded by evacuation † :—

"1. . . . Evacuation offers great opportunities for violent crime, of which the criminal classes are not slow to avail themselves. This fact is pretty well established even without statistical corroboration, and it is generally the practice in this District to issue temporary arms licenses for protection of person and property among the evacuated population.

2. However, I attach hereto statistics of crime due to plague furnished by the District Superintendent of Police, Sholápur.

3. To this I may add that in August 1898, in Akalkot, dacoits raided the evacuated population, looted 5 huts, burnt down 2 huts, seriously injured 2 men and murdered another."

Statement of Crime in the Sholápur District during the last Quarter of 1897.

Nature of offence.								Number.
Dacoities	...	...	...	...	...	...	...	13
Robberies	...	...	...	...	...	...	...	2
House-breakings and thefts	...	...	...	...	...	...	...	17
Thefts	...	...	...	...	...	...	...	18
Total								50

A comparison of these figures with those of previous years show a decided increase in these crimes."

The District Superintendent of Police, Belgaum, reports as follows on this question :— ‡

"Seventeen robberies and dacoities took place in the three months in question, of which 8 may reasonably be put down to the presence of plague.

"5. As regards the question of robberies and dacoities being more frequent on account of the evacuation of villages owing to the presence of plague, I think there can be little doubt that the fact of people living in isolated huts in the fields does tend to increase these classes of crime. For instance, the Gokák dacoity, 1898 ; in this case the complainant was living at a considerable distance from Gokák in a hut quite separate from any one else. I feel convinced he would not have been dacoited had he been living in his house in the middle of Gokák. The same as regards the Pachápur dacoity ; here three women living out in a hut in the fields, about a mile from Pachápur, were dacoited ; they would have been safe in their house in Pachápur. The Nichanki dacoity was due to the isolation of the complainant in a hut, and

* No. $\frac{E. R.}{321}$ of 9th March 1899.

† No. 833 of 19th February 1899.

‡ No. 406 of 15th March 1899.

the two dacoities in Kittur, bad place as it is, would not, I think, have taken place but for the emptiness of the town. I am of opinion that house-breaking is the crime which has increased the most owing to the presence of plague. It is easier and safer to break into a house which has been evacuated than into a house which is occupied."

And Mr. Carmichael, I. C. S., the Collector, agrees with his conclusions.

In comparing the figures for crime for the years 1894, 1895, 1896 and 1898, at Belgaum, those for 1898 are greater than those for 1894 and 1895, and those for 1896 greater than those for 1898. The District Superintendent of Police explains this by saying that 1896 was an exceptional year for crime, but gives no reasons for the rise of crime in that year, and the same argument might perhaps be adduced for the excess of crime in 1898 apart from plague.

(ii.) *Evacuation and Health.*

The statement that evacuation is injurious to the health of the population turned out into the fields is not in accordance either with facts or with the opinions of Collectors and others who have had the best means of judging. This is shown by the extracts from reports for the districts quoted below.

By the Medical Officer, Pálanpur, forwarded by Mr. P. S. V. Fitzgerald, Political Superintendent :—

"As far as my experience goes, I think that life in Camps or Huts in open fields is much more healthy than that in Towns or Villages. I have seen that, during the last epidemic of plague, when the town of Pálanpur as well as other Villages under it that were infected were evacuated and the people were living in huts in open fields outside, they kept their health much better than they did while living in the town or villages either before or after evacuation, notwithstanding the various hardships and sufferings they had then to undergo while living outside. A great many of them were ill-fed, ill-clad, badly sheltered, and, moreover, had to bear up against the inclemency of weather, such as showers of rain, stormy-winds, extreme cold, etc., and yet they kept their health far better than they usually did in ordinary times while living within the town or villages."

The general death-rate from other causes than plague was very much lower than at ordinary times, as will be ascertained by comparing the following figures :—

Pálanpur.

Number of deaths other than plague when people were living in Camps outside the town when there was plague:—	Number of deaths when they were living in the town when there was no plague:—
(1) November 1897 9	November 1898 39
(2) December 1897 18	December 1898 25

The general sickness was also much less than usual."

Kaira :—*

"The people, I think, are much healthier while living in the fields when plague is prevalent. I have visited several of the affected villages and have found them in better health and cheerful spirits. From the conversation I have had with them, I learn that they felt a little hardship in the beginning and suffered slightly from cold, etc., but they after some time found the field-life comfortable. At Umreth I asked some of the people whether they were willing to occupy their houses, but they told me that they would do so after the plague had entirely disappeared from their town. This will show that they prefer to live in fields, because they feel comfortable and healthier."

Khandesh :—†

"The general opinion of the two officers in this District, who have had most experience of plague, is that life in Camps and Huts is more healthy than life in the Villages."

Rewa Kantha :—‡

"I have the honour to state that the only village or town infected with plague in this Agency up to now is Chhota Udepur, and the Administrator of that State reports that

* Collector of Kaira's No. 538 of 25th January 1899.

† Collector of Khandesh's No. 1065 of 1st February 1899.

‡ Political Agent, Rewa Kantha's No. 151 of 31st January 1899.

from the experience recently gained by the evacuation of the town and the residence of the population outside in sheds and other temporary accommodations, Camp-life has been proved to be much healthier than that of the infected locality of the town."

Ahmednagar :— *

"The general health of the population (apart from plague) after evacuation both in the Districts and in the Cantonment and the City of Nagar had considerably improved by living out in the open.

2. Camping out in the open in very cold weather must have been uncomfortable, but there can be very little doubt that for one person injured thereby, nine must have been benefited. Even persons suffering from chronic affections are said to have improved in health ; and my own experience is that one is less likely to catch colds in the open than in houses."

Sholápur :— †

"Dr. Muat reports that though he is of opinion that the general health of the population of Sholápur after evacuation improved, yet he cannot support his opinion by statistics.

In general terms all that I find it possible to say in answer to the question is, that, *under suitable and favourable circumstances*, Camp-life is more healthy than house-life ; pure air, free light and ventilation, and comparative cleanliness and sanitation being the operative factors."

Also—

"In my experience the general health of the people in Camps has been good, with the exception of the period of the rains, about July and August, when the death-rate amongst women in child-birth was excessively high in some villages."

Thána: — ‡

"I have consulted those officers in this District who know most about evacuation, and they tell me what I should have thought was the case that during the latter half of the cold and the whole of the hot season, life in the fields has proved healthier for the people than life in the villages. They suffer, it is true, discomfort from cold and heat ; but in the vast majority of cases their health is not injuriously affected. It is, on the contrary, improved by their breathing a purer air than exists in their dirty stuffy houses."

Panch Maháls :— §

"In my experience, which is confirmed by the views of the divisional and táluca officers in whose charge plague has been prevalent in this District, the general health of the population (apart from plague) after evacuation has been consistently good. Life in Camps or in Huts in the fields has proved as healthy as life in the villages, probably indeed more so, except that the cold this year, which has been more severe than usual, must have been a good deal felt ; however, it does not seem to have proved specially prejudicial to the public health in evacuated villages."

Kolaba :— ||

"As far as my information goes, people enjoy better health in huts in the fields than they do in the villages. I shall be much mistaken if one permanent effect of the plague epidemic is not a considerable movement towards a more open life and a desire to build and occupy houses in the fields instead of in towns."

Broach :— ¶

"It will be seen from the figures of mortality that Camp-life is less healthy than life in the villages. But the facts that mortality is generally heavier during a plague epidemic, and that these villages were evacuated at a time when malarious fevers and other kindred diseases were prevalent, can, to a certain extent, account for the high mortality."

Sávantvádi :— **

"From the experience gained at Shirwal, I am able to say that none of the persons removed to the Segregation Camp suffered from any ailment, and that those not stricken by plague were as healthy in the Camps as they were, or could have been, in their own village."

* Collector of Ahmednagar's No. 993 of 2nd February 1899.

† Collector of Sholápur's No. 658 of February 1899.

‡ Collector of Thána's No. P 272 of 9th February 1899.

§ Collector of Panch Maháls' No. 589 of 9th February 1899.

|| Collector of Kolaba's No. B. P. of 11th February 1899.
991

¶ Collector of Broach's No. 638—P. of 11th February 1899.

** Political Superintendent, Sávantvádi's No. 494 of 10th February 1899.

Káthiáwár :— *

“It will be seen that the general health of the population (apart from plague) after evacuation in Camps or in Huts in the fields was better than in the Villages.”

Belgaum :— †

“The general opinion of the officers I have consulted is that the agricultural population are benefited in health by residence in Camps and Huts. Those classes on the other hand who pursue sedentary occupations and are not accustomed to open-air life suffer to a certain extent when the weather is very cold or very hot, especially when they first go out. They are apt to catch cold or fever, but when they get accustomed to it, the change is rather beneficial than otherwise.”

Dhárwár :— ‡

“The experience of several officers consulted is similar to my own as regards the effect of evacuation on general health. Leaving out of consideration villages evacuated shortly after the close of the monsoon in malarious parts of the District, it would appear that so far as evacuation has any effect on the general health, it is favourable rather than otherwise. In malarious parts of the district a good deal of fever was observed in the evacuated population in November and December, but it is not easy to say if the amount was or was not unusual. The mortality returns are anything but conclusive. Many instances could be given of villages showing a lower death-rate than usual from causes other than plague, some being villages returning few or absolutely no plague cases.

For instance, Nigadi, in the Dhárwár Táluka, with forest on one side and tanks on the other was evacuated on 22nd November 1898. In November, December (1898) and January (1899) there were 4 deaths due to ordinary causes. In the corresponding 3 months last year there were 8 deaths, and in the year before 6 deaths.

In Momigatti, a more or less malarious village in the same táluka, there were 10 deaths during the same quarter in 1898-99, 18 in the corresponding quarter of 1897-98, and 7 in the corresponding quarter of 1896-97. (There was no plague in this village, the evacuation being due to the death of rats in one house.) . . .”

The obvious inference from all these reports is, that, throughout the Presidency, the influence of evacuation on the general health of the evicts has been uniformly beneficial.

(iii.) *Evacuation and efficient Death Registration.*

Collectors disagree on this question. On the one hand, there are those who, with Mr. Cappel, affirm that death registration cannot be efficiently carried out amongst a population living in the fields; and, on the other hand, there are those who, with Mr. Morison, affirm not merely its possibility, but its actual successful performance under evacuation-conditions.

It may well be asked :—

“Where doctors disagree who shall decide?”

The only conclusion that can be arrived at is this: that efficient death registration amongst an evacuated population depends, as do all other plague measures, on the method, energy, and intelligence of the Plague officials on the spot.

(iv.) *Evacuation and the poorer classes.*

It has been said that evacuation imposes great hardships on the poorer classes. As these are the classes who suffer most severely from plague, they are the people who should look to plague measures (and any other available succour) most eagerly and willingly. The question resolves itself at last for them into a choice of evils: and they, having by bitter experience gradually learned the lesson, seldom hesitate now to choose the least.

* Political Agent, Kathiawar's No. 894 of 23rd February 1899.

† Collector of Belgaum's No. 1179 of 24th February 1899.

‡ Collector of Dhárwár's No. ^{B. P.} 1058 of 8th March 1899.

CHAPTER I.

Part IV.—Inoculation.

The experience of plague and measures for its management acquired in Bombay during the past 3 years has demonstrated that the ordinary means used for "stamping out" the disease have not met with the success hoped for. The fact is forced upon one that, in a large town, once the disease has taken root, it will re-appear year after year, and that—so far as present experience guides us—its virulence will show no sign of diminution, as is the case with some other epidemic diseases. If the disease then cannot with certainty be "stamped out," the only other resource left is to try to render the people of the infected town immune to plague, so that, though living with the cause of the disease all round them, they may remain free from attack. It is only necessary to refer to the effects of vaccination for small-pox, to make it clear that it is not impossible to immunise a population, so that, though conditions giving rise to a disease may exist in nature all around, yet cases of that disease are comparatively rare. It is a well-known fact that diseases, such as small-pox, typhoid fever, cholera, etc., appear as a rule only once in the same individual, and a person who has recovered from an attack of one of these has the comfortable conviction that in all probability he will not suffer again. He or she has become "immune" to that disease. It has been ascertained that these "zymotic" diseases as they are called, are each one caused by a special germ of its own. These germs can be separated from the bodies of persons suffering from such disease, and grown on suitable media in laboratories. From these germs each disease can be produced, just as cereal crops can be produced by sowing the seed of the required grain in suitable soil. Each grain produces its own particular crop and no other, so each different germ of disease produces its own disease and no other. One important difference, however, appears, *viz.*, in the case of cereals one can go on, year after year, sowing the same crop in the same field, and a yield will be produced and a harvest reaped. In the human body, on the contrary, the seeds of disease having once been sown, and the disease crop matured, *a second crop will not grow*. Even if the seeds are sown, they do not germinate, the available material in the soil has been used up, or the soil has been so altered that no second disease-crop can be produced; in other words, *the individual has become immune*. It is believed that immunity is caused by the reaction of the body to the poison excreted by the disease-germs as they grow in the body. If, then, we cause the germs to manufacture their poison in bottles, and, after killing them by heat, inject a measured quantity of this fluid, the same effect will be produced on the body soil as though the germs had actually lived in that body and produced their poison there. It was considerations such as these that guided Haffkine in working out "vaccines" for cholera and plague, and the success or otherwise of his plague prophylactic may be judged from the statistics now to be given.

As the results of 3 months' labour at the life-history of the plague bacillus, Haffkine was able to inform the Government of India, in a letter dated 16th January 1897, that he had been able to prepare an inoculation fluid, which promised, on the analogy of the results obtained previously by Pasteur in connection with anthrax and rabies, and by himself in the case of cholera, to produce in the human organism a considerable resistance to plague. The now well-known effect on human beings he described from its action on himself, as he had been inoculated with a dose which turned out to be 4 times stronger than that now fixed as the standard. Shortly afterwards, 77 leading citizens of Bombay were inoculated to demonstrate publicly the complete harmlessness of the operation. The preparation of the prophylactic is detailed in the *British Medical Journal* for June 12th, 1897, and the *Indian Medical Gazette* for June 1897, and though

many improvements have since been introduced in its manufacture, the principles as therein laid down remain unaltered. The first trial of the prophylactic on a plague-stricken community was made in the Bombay House of Correction at Byculla. Plague broke out there on the 23rd of January 1897, 9 attacks with 5 deaths occurring between that date and the 29th of the same month. On the 30th of January, 6 more cases, of which 2 proved fatal, occurred. In the afternoon of that day inoculation was offered to the prisoners, and about half the population of the Jail volunteered. Three of the inoculated developed plague the same evening, and all of these died. These cases manifestly had plague in their systems already—in fact, one actually had a visible bubo at the time of inoculation—and are therefore excluded from the following table of results obtained in the two groups of “inoculated” and “uninoculated”:—

	Cases.	Deaths.
172 Uninoculated	12	6
147 Inoculated	2	...

This result, having become known, naturally encouraged the inhabitants of Bombay City to apply for inoculation in large numbers, and during the course of the season of plague prevalence, *i. e.*, up to October 1897, altogether 8,142 persons were operated on. The following table shows that the inoculated persons belonged to all castes and ages :—

<i>Sex and Age distribution.</i>				<i>Race distribution.</i>			
Adult males	...	...	5,259	Parsis	...	...	3,414
				Brahmins	...	...	298
				Kshatriyas	...	...	486
„ females	...	...	1,668	Vaisyas	...	...	219
				Sudras	...	...	805
				Other Hindu Castes	...	...	339
Children of 10 years and under	...	...	1,079	Mahomedans	...	...	1,478
				Europeans	...	...	467
				Native Christians	...	...	414
Unclassified	...	...	136	Jews	...	...	81
				Japanese	...	...	2
				Unclassified	...	...	136

In this early period in the introduction of inoculation it is probable that all cases of plague appearing among those inoculated were promptly reported to the Laboratory staff, as the whole medical profession in Bombay were watching its effect with the keenest interest.

The following list of attacks and deaths among the 8,142 inoculated persons may therefore probably be taken as fairly accurate. 20 cases of undoubted plague and one doubtful one were thus reported and investigated by officers of the Laboratory. Of these 4 died (including the doubtful case) and 17 recovered. Two of these were ascertained to have had the signs of the disease on them at the time of inoculation, and therefore may be left out of account, as the inoculation does not profess to be curative in this sense.

Inoculation has been introduced at various places on a large scale with striking success. The cases in which accurate records of such inoculation have been kept have been arranged, in chronological order, and are given seriatim below :—

I. *Mora*.—In the middle of March 1897, in the village of Mora to the south of Bombay Harbour, in Uran Municipality, with a population of about 1,000 inhabitants, 419 were inoculated. Only 7 of these were attacked by plague, and all recovered. In the uninoculated portion of the population, according to information furnished by the local Parsis, 26 cases occurred, of whom 24 died.

2. *Damaun*.—This town, situated in Portuguese territory to the north of Bombay, and in constant communication with it by sea, was affected in February 1897. Its population was originally 10,900, but at the end of March had been reduced by flight and plague to 8,230. A cordon was now drawn round it by this Government, and inoculation was begun there on the 23rd March 1897: three series of inoculations being performed between the following dates:—

23rd to 26th March,
17th April to 2nd May,
21st and 23rd May.

The total number inoculated during these three periods was 2,197; and a searching investigation of the results obtained was made by Major Lyons, I. M. S., who visited every house where a plague case occurred.

The results classified by periods were as follows :—

NOTE.—In the following tables the total numbers shown as inoculated are progressive : i. e., the numbers for the second period *include* those for the first period : and those for the third period include the numbers for both first and second periods. The deaths also amongst the inoculated have been deducted in each case.

1st Period, 23rd March to 16th April.	Operators.	INOCULATED.				NOT INOCULATED.		
		Numbers.	Cases.	Deaths.	Percentage of Mortality.	Numbers.	Deaths.	Percentage of Mortality.
	Dr. Kalapesi ...	846	17	3	0·4			
	Dr. Poiares ...	171	6	3	1·8			
	Total ...	1,017	23	6	0·58	7,213	716*	9·9

* Number of cases not known.

Dr. Poiares used the same vaccine as Dr. Kalapesi, but gave smaller doses, so his results were not so good. *If the 1,017 inoculated had suffered in the same proportion as the uninoculated, they should have had 101 deaths, instead of 6—a difference of 94·0 per cent.*

2nd Period, 17th April to 2nd May.	Operators.	INOCULATED.				NOT INOCULATED.		
		Numbers.	Cases.	Deaths.	Percentage of Mortality.	Numbers.	Deaths.	Percentage of Mortality.
	Dr. Kalapesi ...	1,372	52	18	1·3			
	Dr. Poiares ...	267	12	9	3·3			
	Total ...	1,639	64	27	1·6	5,869	674*	11·5

Number of cases not known.

The vaccine used for the second series was much weaker than that previously employed, as the Laboratory was unable, in this initial stage, to meet the increasing demands which arose on all hands. The results obtained were therefore less effective.

If the inoculated had suffered in the same proportion as the uninoculated, they should have had 188 deaths, instead of 27—a difference of 85 per cent.

3rd Period, 22nd to 31st May.	Operators.	INOCULATED,				NOT INOCULATED.		
		Numbers.	Cases.	Deaths.	Percentage of Mortality.	Numbers.	Deaths.	Percentage of Mortality.
	Dr. Kalapesi ...	1,906	1	1	0·05			
	Dr. Poiares ...	258	3	2	0·8			
	Total ...	2,164	4	3	0·14	4,643	93	2·0

If the inoculated had suffered in the same proportion as the uninoculated, they should have had 43 deaths, instead of 3—a difference of 93 per cent.

Taking the period as a whole, the following is the result obtained :—

2,197 inoculated had 36 deaths, or 1·6 % of mortality.

6,033 not inoculated had 1,482 deaths, or 24·6 % of mortality.

As a large number of families in Damaun were entirely inoculated, and so had no uninoculated individuals living with them for comparison, it was found necessary to compare the whole inoculated population with all those not inoculated remaining in the town. But if those houses be singled out in which only a portion of the inhabitants had been inoculated, the following result is obtained. In 62 houses there were living 250 inoculated, and also 124 not inoculated :—

	Numbers.	Cases.	Deaths.	Percentage of Mortality.
Inoculated	250	50	20	8·0
Not Inoculated	124	54	37	29·8

If the 250 inoculated had suffered to the same extent as the 124 uninoculated, they should have had 75 deaths, instead of 20—a difference of 73·3 per cent.

From the above it would appear that uninoculated individuals living in the same houses as those inoculated are a source of danger to them, and therefore inoculated people are advised to see that those in immediate contact with them (*i. e.*, family and servants) are likewise operated on. It is just as much a duty to the public to be inoculated during plague-prevalence as to be vaccinated when small-pox appears in the neighbourhood.

A striking illustration of the effect produced by the inoculation of an entire community is afforded by the history of this epidemic among the Parsi inhabitants of Damaun. The Parsi community of Lower Damaun numbered 306. Of these, 277 were inoculated and 29 were not. The following shows the attacks and deaths in the two groups. No death from any other cause than plague occurred in this community during the epidemic :—

	Numbers.	Cases.	Deaths.	Percentage of Mortality.
Inoculated	277	8	1	0·36
Not Inoculated	29	4	4	13·8

If the inoculated, who were living in precisely the same social conditions as the uninoculated, had been affected in the same proportion, they should have had 33 deaths instead of only one.

It should be noted that the solitary case of death among the inoculated had pain in the groin and fever at the time of inoculation—in fact, was suffering from *plague already manifest*,—and therefore could not be expected to derive benefit from the prophylactic.

3. *Lanowli*.—A small hill-station and railway depôt at the top of the Bhor Ghât was the scene of the next demonstration. Plague first appeared here in April or May 1897, and about 20 cases occurred. The disease subsided, but, after the onset of the monsoon, re-appeared in epidemic form, at a time when, owing to the departure of the summer visitors, the population numbered only about 2,000. Operations were begun towards the end of July 1897, in C and D Wards of the town, these having been chosen by the local Plague Committee for trial. A census having been made, inoculations were begun on 24th July 1897, and continued daily, as opportunity arose, among the friends and neighbours of those attacked. A daily house-to-house inspection was kept up in these wards for weeks after this, and the figures given below show the result obtained.

*Table showing the incidence of Plague in C and D Wards of Lanowli in 1897.
Days showing no occurrences are omitted.*

Date.	Uninoculated population.	Cases.	Deaths.	Inoculated population.	Cases.	Deaths.
24th July 1897	711	4	4	45	...	...
25th do.	636	5	5	116	...	...
26th do.	621	4	3	126	...	...
27th do.	568	2	2	175	...	...
28th do.	544	3	3	197	...	...
29th do.	472	2	1	266	...	...
30th do.	460	6	4	276	...	...
31st do.	430	3	2	300	1	1
1st August 1897	398	8	6	328	3	1
2nd do.	373	8	6	342	3	2
3rd do.	341	1	1	363	1	...
4th do.	336	3	2	365	1	...
5th do.	331	1	...	368	1	...
6th do.	329	3	1	367	...	...
8th do.	323	1	...	370	...	...
9th do.	322	1	1	370	...	...
10th do.	320	1	...	371	1	...
11th do.	319	1	1	370	...	...
12th do.	318	1	...	370	1	1
13th do.	316	1	1	370	...	...
14th do.	315	1	...	370	...	...
17th do.	314	1	...	370	...	...
19th do.	313	1	1	370	1	1
20th do.	312	1	...	369	...	...
22nd do.	311	6	5	369	...	...
23rd do.	305	...	...	369	1	1
26th do.	305	1	1	368	...	...
3rd September 1897.	304	1	1	368	...	...
4th do.	303	1	...	363	...	...
6th do.	302	1	1	368	...	...
7th do.	301	3	3	368	...	...
13th do.	298	1	1	368	...	...
23rd do.	297	1	1	368	...	...

Taking the average daily strength of the two groups and comparing them, it is seen that 377 uninoculated had 78 cases with 57 deaths : while 323 inoculated had 14 cases with 7 deaths.

If the inoculated had suffered in the same proportion as the uninoculated, they ought to have had 49 deaths, instead of 7—a difference of 85·7 per cent.

4. *Kirkee*.—Plague broke out here in the Artillery Cantonment, situated 4 miles from Poona, and the followers of the four batteries stationed there suffered severely. These men were living with their families in lines on a sloping plain, under military discipline, and in circumstances far superior, in a sanitary sense, to those of the average villager. When the disease appeared the lines were isolated, so that none could enter or leave without the knowledge of the military authorities. A special hospital was erected close by, where all sick persons were sent as they were discovered by the search parties of European Artillerymen, who visited each house thrice daily. It is therefore probable that all cases of plague were promptly discovered and removed to hospital, and in each case the usual disinfection was thoroughly and promptly carried out. Yet, in spite of all this, it was found that, in those not protected by inoculation, 1 out of every 6 of the population was attacked, and 2 out of every 3 attacked died. The epidemic was therefore a severe one. The population of the lines numbered 1,530; and out of these, 671 volunteered for inoculation. At the close of the epidemic the plague hospital admission and discharge book was examined, and compared with the register of those inoculated, with the following results. The circumstance that the population operated on were under military discipline, and confined to their lines by a cordon, renders the accuracy of the figures undoubted.

	Numbers.	Cases.	Deaths.	Percentage of Mortality.
Inoculated	671	32	17	2·5
Not inoculated	859	143	98	11·4

Here, then, is seen a body of people divided into two groups by the fact that one had undergone inoculation and the other not, *but differing in no other way*, reacting towards plague in such a markedly different manner that the conclusion is forced on one that the inoculation must be the cause. This absolute similarity of conditions considered, the 671 inoculated should have had proportionately 112 cases and 77 deaths if they had remained as susceptible to the disease as their uninoculated brothers, sisters, parents, wives, husbands, children; but instead of that, they had only 32 cases and 17 deaths, *or a reduction in the death-rate of 77·9 per cent.* Reduced as the death-rate is, it would doubtless have been much more so, but for the fact that a very much weakened vaccine had to be used, owing to the demand having got beyond the resources of the Laboratory at that time.

5. *Belgaum*.—Plague cases began to appear in Belgaum—a town of 40,700 inhabitants—in October 1897, five deaths being reported in that month. In November, 111 deaths occurred, 156 in December, 226 in January, and 50 in February 1898, after which an insignificant number of attacks took place, till in May the epidemic ceased. The 26th Regiment of Madras Infantry were, during this period, living in lines close to the Cantonment and City, and suffered similarly. The first reported case among them took place on 12th November, when Sepoy 2224, Govindaswamy, was brought to hospital and died the same day. Next day another sepoy was attacked and also died. On the 15th a drummer was seized, and on the 17th the disease appeared among the followers. By the 21st, 13 attacks had been reported from the lines, 4 of these being among sepoys. On the 22nd November the Companies most severely attacked were moved out into camp, and by the 28th the whole regiment, families, and followers had left the lines. These were then disinfected by washing with perchloride of mercury solution, whitewashing, and removal of tiles from the roofs. During this transition period

15 persons were seized, 6 of them being sepoys. In the ten days following removal to camp, 13 sepoys and 20 among the families and followers were attacked. Then removal from the infected locality had its usual effect: the cases gradually became fewer, and ceased by the end of the year. The following table summarises the events of this period, *i. e.*, 12th November to 31st December 1897.

Among Sepoys, 34 cases, with 22 deaths = 64·7 per cent. of mortality.

„	Women,	20	„	„	10	„	= 50·0	„	„
„	Children,	16	„	„	9	„	= 56·25	„	„
„	Followers,	8	„	„	8	„	= 100·0	„	„
Total ...		78	„	„	49	„	= 62·8	„	„

An officer of the Plague Research Laboratory was sent to Belgaum, and commenced operations there on 24th December. No difficulty was experienced in persuading the men to consent to inoculation: and all the sepoys who were off duty that day in the Hindalgi Camp (229) were operated on during the morning, and allowed to return to their lines next day. Those in other camps and the families were speedily inoculated and allowed to return also. The return was complete by the 30th December. A few more inoculations continued to be done up to 6th January 1898, among followers and children, but the regiment was practically a completely inoculated community by the end of the year. The total operated on was 1,665, out of a population of 1,746 living in the lines at that date. The 81 not operated on were infants, women far advanced in pregnancy, and the sick in hospital chiefly, though one solitary sepoy has up to the present time refused to submit to the operation.

After this date two cases occurred in January, the sufferers being a European officer and a sepoy, both employed in disinfection work in the town; they had both been inoculated and both recovered. No cases were reported for the next 6 months, though, as shown above, the epidemic was at its height in the neighbouring city and cantonment in January, and the men were allowed freely to go to these places after inoculation. That this practical immunity of the regiment was not due merely to the disinfection of the lines will be manifest to anyone studying the occurrences during the second epidemic from July to December 1898, now to be described. The second epidemic in Belgaum Town began in June, reached its height in October, and thereafter declined till January 1899, when it ceased. The table given below shows the number of deaths from plague (the attacks were, of course, many more, but no accurate figures are forthcoming on this head) reported in the City and Cantonment, month by month, contrasted with the attacks and deaths in the Regiment.

Dates.					Deaths reported from City and Cantonment.	Attacks in the Regiment.	Numbers of those attacked in the Regt. who died.
June	1898	...	...	...	14	...	...
July	„	...	...	...	215	1	1
August	„	...	...	...	304	2	1
September	„	...	...	...	698	2	1
October	„	...	...	...	999	4	2
November	„	...	...	...	275	2	1
December	„	...	...	...	65	1	0

From the above it is manifest that the numbers attacked and the subsequent fatalities in the Regiment kept pace exactly with the severity of the epidemic in the neighbouring town, rising and declining with it. The conclusion is therefore inevitable that the same infection that was producing such havoc in the civil population was equally present in the lines of the military, yet they suffered in proportion 22 times less at the height of the epidemic. In the City and

Cantonment 2,570 persons died of plague, or 1 in every 17 of the population, while in the sepoy's lines, with a population of 1,801, but 6 died, or at the rate of 1 in every 300 only. It has been shown how heavily the Regiment suffered during the first epidemic; why, then, did they not again produce cases to the same extent during the more severe second visitation? The only measures taken by the authorities were, placing the Cantonment and City "out of bounds" for the troops after 4th July, and disinfection of the few huts that became infected. But both these measures had been taken in the first outbreak and had proved totally inadequate to stay the ravages of the disease, until the men were removed from the infected locality. A very practical answer to this question was given by the sepoy's themselves, who volunteered to undergo a second inoculation, which was duly carried out during July and August. Practically no one was left in the lines unprotected by inoculation, so that a comparison cannot be made with an unprotected population living in precisely similar circumstances, as was possible in the first experiment in the Byculla Jail, for instance, yet, in the opinion of the sepoy's and their officers, there is no doubt that the inoculation saved them. Nine out of the 12 cases of plague in the Regiment occurred in the persons of inoculated people, and 3 among non-inoculated. Of the former 6 recovered and 3 died; among the latter all died. The history of the three uninoculated persons is interesting. The first case was that of a sepoy who was believed to have already suffered from plague in the first epidemic, and who was not inoculated on the presumption that he would prove immune. From a study of the history of his case as recorded in the hospital case-book, it appears probable that a mistake in diagnosis had been made, during the hurry and stress of the first epidemic, and that the man had not suffered from plague previously. The second case occurred in the person of a sepoy's wife who had just joined her husband and who was attacked before she could be inoculated. The third was a European officer who probably trusted to the comparative immunity of his race, and had therefore omitted to protect himself.

C. Major Forman's statistics.—Two very striking instances brought to notice by Major Forman, R. A. M. C., Senior Medical Officer at Belgaum, may here be stated. The men of the Army Hospital Corps, with their families, were living close to the European Military Hospital under constant supervision. They numbered 83 individuals, and all but 3 submitted to inoculation. On December 23rd, 1897, the operation was performed, and the following occurrences among them are recorded:—

	Population.	Cases.	Deaths from Plague.
Inoculated	80	...	...
Not inoculated	3	2	2

In January 1899 this group of persons, who then numbered 84, got themselves inoculated again, with the exception of 7, with the following result:—

	Population.	Cases.	Deaths from Plague.
Inoculated	77	2	2
Not inoculated	7	1	1

As these people were living isolated from others, and under daily medical supervision, errors of diagnosis are practically excluded, and the results recorded may be taken as accurate. The non-inoculated group in this case suffered from plague nearly 24 times more severely than those protected.

7. *Umerkhandi Jail, Bombay*.—Plague appeared in this jail in the end of December 1897. Three prisoners took the disease and subsequently died. Then on 1st January 1898, inoculation was offered to the prisoners, who all, 401 in number, declared themselves willing to undergo the operation. It was resolved, however, for the purposes of demonstration, that only one-half of each group of prisoners should be operated on. Two prisoners only refused to allow inoculation. No distinction was made between the groups of inoculated and uninoculated prisoners; they had the same food and drink, the same hours of work and rest, and the same accommodation. After this, plague cases appeared at intervals for a space of 30 days, and were distributed as follows. During this time an almost equal number of releases took place in the two groups, and the average daily strength exposed to the disease up to the end was 147 inoculated and 127 not inoculated.

Average.	Population.	Cases.	Deaths.	REMARKS.
Inoculated ...	147	* 3	.....	* The disease was so mild in these cases that the hospital authorities were doubtful whether they were cases of plague.
Not inoculated.	127	10	6	

8. *Undhera*.—Plague broke out in this agricultural village, which is situated 6 miles from Baroda, in the end of December 1897. According to a census taken by the Baroda authorities on 5th January 1898, there were 1,031 souls in the village. Between that date and 12th February, when the inoculations were performed, 76 persons died of plague, 10 had left the village, and 5 were born, thus leaving 950 persons alive on the latter date. This is equivalent to a death-rate of 766 per mille per annum, and will serve to show how virulent the epidemic was. On 12th February the village was visited by Mr. Haffkine, Major Bannerman, Indian Medical Service, the chief Plague authorities of Baroda State, and some half-dozen local medical men, and by them inoculation of 513 of the inhabitants was carried out the same day. By reference to the census papers the whole of the inhabitants were called out house by house, and the half of each section of each household inoculated. In this way an endeavour was made to inoculate half the men, half the women, and half the children in each family, and to arrange that a fair proportion of the sickly-looking should be placed in each division.

An investigation as to the results of the inoculations in Undhera was made on 4th April 1898 by Surgeon-Major-General R. Harvey, Director-General, Indian Medical Service; Mr. Haffkine, Major Bannerman, I. M. S., and Captain Dyson, I. M. S., with the aid of the local authorities of Baroda. Each house in which a plague case had occurred since the 12th February was visited, and the occurrences among the members ascertained by personal inquiry from the survivors, by reference to the hospital register, and from the census papers in which the doses of prophylactic administered had been entered. The following is the result of this investigation. The plague continued in the village for 42 days after the inoculations were performed, and affected 28 families only: and these families are therefore alone dealt with below.

Among the inoculated.

(a) There were no deaths from causes other than plague.

(b) There were no deaths during the first 3 days after inoculation, the first fatality being recorded on the 21st, 8 clear days after.

(c) From the 15th February till the end of the epidemic there were 8 attacks of plague, of which 3 proved fatal.

Among the uninoculated.

(a) A child aged 1 year died of bronchitis on 21st February 1898.

(b) Three died of plague during the first 3 days following the inoculation, and are therefore omitted from the calculations as having been attacked before those in the other section were operated on.

(c) From the 15th of February till the end of the epidemic, 27 more attacks of plague occurred, of whom 26 died.

One of the three fatal cases among the inoculated had no interval between the inoculation fever and the manifestation of plague; the others had apyretic intervals of 6 and 8 days respectively.

The events in each of the 28 families were noted on separate investigation sheets, in which the names of every member present at the time of inoculation were entered as either "inoculated" or "not inoculated." The occurrences in each household being entered in each sheet below the names, it was then easy to compile the following table:—

INOCULATED.			NOT INOCULATED.		
Number inoculated in the 28 families.	Number of Attacks.	Number of Deaths.	Number not inoculated in the 28 families.	Number of Attacks.	Number of Deaths.
71	8	3	64	27	26

If the inoculated had suffered to the same extent as their uninoculated relatives, they should have had 29 deaths from plague, instead of 3 only, which is equal to a diminution of 89·6 per cent. of mortality.

From the above account of the way in which this demonstration was carried out, it will be evident that the conditions approached very nearly the strictness of a laboratory experiment, and the results obtained may therefore be accepted with confidence.

9. *Khoja Community of Bombay.*—Thanks to the energetic support of H. H. Aga Khan, inoculation was successfully introduced amongst the Khojas in 1897. By the 20th April 1898, 5,184 of this community had been operated on. As the operations extended over 16½ weeks, it is necessary to take the average number for comparison with the uninoculated portion of the community, and this is found to be 3,814 persons. In the beginning of 1898 a careful census of the Khojas in Bombay was taken, which showed that 9,350 Khojas were in the city at that time. But as many families had left the city through fear of plague, a calculation was made from the average number of deaths registered in the burial-book of the Jamat Khana for the five years previous to the appearance of plague, and it was decided that 13,300 should be taken as representing the total Khoja population. This exaggerated number, $\frac{2}{3}$ more than that found at the census, is taken so as to avoid the risk of increasing unduly the death-rate among the uninoculated, in the calculations that follow. It is found then that there were during this period in Bombay 3,814 (average) inoculated and 9,516 (purposely exaggerated) uninoculated Khojas. Between 27th December 1897 and 20th April 1898, there were 184 deaths in the Khoja community. Of these 6, including 2 from plague, were in those inoculated in 1896-97 and not re-inoculated since; 7 deaths, including 3 from plague, occurred in the 5,184 inoculated or re-inoculated during the above period, and 171 deaths took place among the uninoculated.

Calculating from the normal average death-rate during these months among the community for some years previous, it appears that one should expect 102 deaths from natural causes, but as 184 deaths were actually recorded, it may fairly be assumed that the 82 extra deaths were due to plague. Of these 82 plague deaths, 3 occurred in those inoculated between 27th December 1897 and 20th April 1898, 2 in those inoculated during the previous epidemic, and 77 among the uninoculated. These details were carefully ascertained by a

house-to-house visitation conducted by Mr. Haffkine personally, by examination of the burial-book at the Jamat Khana, and by the inoculation documents in the Laboratory. The distribution of deaths in the two groups is shown below :—

	Population.	Deaths from plague.	Deaths from other causes.
Inoculated... ..	3,814	3	4
Not inoculated	9,516	77	94

Admitting that not more than 77 deaths among the uninoculated were due to plague, and supposing that the inoculated had remained after operation as susceptible as before, they ought to have had 31 deaths from plague, instead of 3 only ; or a difference of 89·7 per cent. in favour of the inoculated.

10. Hubli.—Plague appeared in this mercantile town of 52,000 inhabitants in the end of 1897. It then disappeared for a time, only to break out once more on the approach of the monsoon. “The average rainfall between April and October amounts to more than 28 inches. Under these circumstances, although a large and weather-proof health camp had been prepared for emergencies, complete evacuation of the infected town-site was impossible, and the attempt to effect it would have led to the severest hardships and to the immediate spread of the disease into surrounding villages and districts.” It was for this reason, as Mr. Cappel the Collector—whose words have just been quoted—remarks, that inoculation was tried so extensively, being the only feasible measure under the circumstances. As Mr. Cappel further remarks, “Inoculation seems therefore to be pre-eminently adapted for large towns and industrial places at all times, and in the rains it is, so far as present experience shows, the only method of staying the disease which can be relied on.”

The enormous numbers inoculated, and the size of the town itself, precludes any such accuracy of figures as was attained in the small village of Undhera, for instance, but still the following figures taken from Captain Leumann’s Report to Government may be taken as substantially correct. The inoculations were begun on the 11th of May 1898, and between that time and the 27th September, 38,712 persons were operated on :—

Dates.	Actual population of Hubli as per weekly census.	Numbers not inoculated.	Numbers inoculated.	Plague deaths among not inoculated.	Plague deaths among inoculated.
11th May to 14th June 1898	{ Fell from 50,000 to 47,427 }	44,573	2,854	47	1
Week ending 21st June	47,082	41,494	5,588	22	3
“ 28th “	47,485	39,042	8,443	29	1
“ 5th July	46,537	36,020	10,517	55	6
“ 12th “	46,518	33,255	13,263	34	6
“ 19th “	45,240	29,716	15,524	82	7
“ 26th “	43,809	24,112	19,697	100	15
“ 2nd Aug. “	43,707	21,031	22,676	140	16
“ 9th “	42,768	15,584	27,184	272	19
“ 16th “	40,441	10,685	29,756	386	61
“ 23rd “	39,400	6,367	33,033	371	41
“ 30th “	38,210	4,094	34,116	328	28
“ 6th Sept. “	38,382	2,731	35,469	227	34
“ 13th “	38,408	1,116	37,292	138	46
“ 20th “	39,142	937	38,205	106	35
“ 27th “	39,315	603	38,712	58	20

Discarding the figures in the first row as not being accurate, the average population under “Not inoculated” and “Inoculated” respectively for 15 weeks is as in the following table, where also the occurrences in each group are shown:—

Average Population.				Deaths from Plague.	Percentage of Mortality.
Inoculated	...	...	24,631	338	1·3
Not inoculated	...	...	17,786	2,348	13·2

In other words, 1 in every 72 of the inoculated population died, while 1 in every 7 of the uninoculated succumbed to plague.

11. *Southern Mahratta Spinning and Weaving Company’s Mill.*—The experience in this Company’s Mill at Hubli should be an object-lesson to mill-owners in plague-stricken towns. On the 21st of June 1898 there were 1,173 mill-hands on the muster rolls.

Population.				Deaths from Plague.	Percentage of Mortality.
Inoculated twice	...	...	1,040	22	2·11
Inoculated once only	...	...	58	8	13·79
Not inoculated	...	...	75	20	26·66
Total ...			1,173		

If the 1,098 inoculated persons had remained as susceptible to plague as the 75 not inoculated, they ought to have lost 292 by death, instead of 30 only.

12. *Dharwar.*—A town of some 32,000 inhabitants, situated in the Southern Mahratta Country, 13 miles from Hubli, and the head-quarters station of the Southern Mahratta Railway. Plague broke out here during August 1898, and inoculation work was begun almost at once by the Civil Surgeon, and afterwards continued and practised on a large scale by Dr. Miss Corthorn, who was sent there on special duty, and from whose report the following figures are taken. During the 12 weeks covered by this report, from September 2nd to November 16th, 1898, the population actually residing in the town averaged 21,088, the rest having fled to the fields or jungle in the neighbourhood. Of these persons, 2,367 were operated on once, and 1,864 twice ; while 16,848 remained uninoculated.

The table below shows the incidence of plague among the inoculated and uninoculated:—

Average Population present.		Cases.	Deaths.	Case incidence.	Case mortality.
Inoculated	... 4,231	129	54	3·04 %	41·8 %
Not inoculated	... 16,848	1,100	889	6·5 %	80·8 %

If, therefore, the inoculated had remained as susceptible to plague as their fellow-townsmen, they should have shown 270 cases with 223 deaths, instead of 129 and 54 respectively.

Owing to the careful way in which the records of the inoculation work were kept, it is possible to pronounce an opinion on the effect of inoculation on those actually in the incubation stage of plague. In Dharwar 74 individuals developed plague within 10 days of operation. As 10 days is generally admitted to be the limit of the incubation period, we may assume that many of these persons had already the plague-germs in their bodies at the time of inoculation. The following statement shows that the death-rate at no time exceeded that among the uninoculated population (80·8 %), and was generally very much below this. It is evident, then, that inoculation of persons incubating plague does not do any harm, but, on the contrary, increases their chance of recovery.

	Cases.	Recoveries.	Deaths.	Percentage of Mortality.
Inoculated (with plague actually developed) ...	5	4	1	20 0
Developed plague on day of inoculation ...	5	3	2	40·0
„ „ within 2 days of inoculation ..	13	9	4	30·7
„ „ „ 4 „ „ ...	7	2	5	71·4
„ „ „ 6 „ „ ...	19	8	11	57·8
„ „ „ 10 „ „ ...	25	21	4	16·0
Total within 10 days of inoculation ..	74	47	27	36·5

13. *Gadug*.—A town in the Dharwar district of some 23,000 inhabitants. Plague appeared here shortly after Dharwar itself was attacked. From Dr. Miss Corthorn's report of her work there, the following information has been obtained.

In the 28 weeks from 18th November 1898 to the end of May 1899, which is the period dealt with in the report, the incidence of plague was as follows:—

Average Population.	Cases.	Deaths.	Case incidence.	Case mortality.
Inoculated once ... 1,365	32	14	2·3 %	43·7 %
„ twice ... 11,639	161	69	1·4 %	42·8 %
Not inoculated ... 4,163	278	216	6·6 %	77·7 %

If the 13,004 inoculated had suffered to the same extent as those not inoculated, they ought to have had 868 cases with 674 deaths, instead of 193 and 83 respectively.

14. *Belgaum Cantonment*.—A severe epidemic broke out in Belgaum Town and Cantonment in April, and continued throughout May, June, July and August of the current year. In the Cantonment, inoculation was vigorously pushed by the Plague Committee, who carefully watched and recorded the results. These are given in the table below which explains itself:—

*Results of Inoculation in Belgaum Cantonment.**

Week ending	Number inoculated during the week.	TOTAL POPULATION, 9,543.		WEEKLY NUMBERS OF		REMARKS.					
		A.—Inoculated	B.—Uninoculated.	Cases.	Deaths.						
12-5-99	9,543	{ A. 1,230 B. 8,313	14 34	8 19	Percentage of mortality on average population.	83 7.59				
19-5-99 ...	898	"	{ A. 2,128 B. 7,415	10 17	4 6						
26-5-99 ...	451	"	{ A. 2,579 B. 6,964	5 31	3 19						
2-6-99 ...	231	"	{ A. 2,810 B. 6,733	3 27	... 21						
9-6-99 ...	199	"	{ A. 3,009 B. 6,534	10 32	3 21	Total deaths.	40	346			
16-6-99 ...	165	"	{ A. 3,174 B. 6,369	1 45	3 26	Total cases.	87	506			
23-6-99 ..	74	"	{ A. 3,248 B. 6,295	2 34	... 19	Population.	4,842	4,558			
30-6-99 ...	113	"	{ A. 3,361 B. 6,182	1 33	2 22	Average weekly inoculated population throughout epidemic ... Do. uninoculated					
7-7-99 ...	310	"	{ A. 3,671 B. 5,872	3 47	1 34						
14-7-99 ...	648	"	{ A. 4,319 B. 5,224	4 71	1 50						
21-7-99 ...	1151	"	{ A. 5,470 B. 4,073	6 51	4 33						
28-7-99 ...	1254	"	{ A. 6,724 B. 2,819	4 30	3 36						
4-8-99 ...	1145	"	{ A. 7,869 B. 1,674	4 24	2 15						
11-8-99 ...	313	†	{ A. 8,182 B. 870	12 18	3 15						
18-8-99 ...	546	†	{ A. 8,048 B. 626	5 6	3 6						
25-8-99 ...	Only 2 cases and 2 deaths in the whole cantonment.										
1-9-99 ...	77	8,947	{ A. 8,590 B. 357	3 1	... 1						
8-9-99 ...	134	9,064	{ A. 8,749 B. 315	... 5	... 3						

* Taken from Collector of Belgaum's weekly report.

† Cause of decrease—probably flight.

If, therefore, the inoculated had suffered to the same extent as the uninoculated, they should have had 537 cases with 367 deaths instead of 87 and 40 respectively.

15. *Employes of the Southern Mahratta Railway, Hubli.*—These persons were living in barracks, and in the Railway yard apart from the general population of Hubli town. They were under close daily inspection by English officials, who formed a committee for this purpose, with Dr. Chenoi as their medical adviser. The results given below may therefore be regarded as accurate to a high degree, the numbers dealt with not being excessive, and the supervision strict. Inoculation was begun early in June 1898, and after its introduction plague cases appeared on 29 different dates between 11th June and 6th October of that year.

In the following table “average” populations have been taken in each case, as the numbers present on each date when plague appeared varied; the numbers inoculated steadily increasing, while those not inoculated correspondingly decreased :—

	Numbers.	Attacks.	Deaths.
Twice inoculated ...	990	6 (0·6 %)	1 (0·1 %)
Once „ ...	270	5 (1·8 %)	1 (0·3 %)
Not inoculated ...	760	35 (4·6 %)	21 (2·7 %)

If the 1,260 inoculated had suffered to the same extent as the 760 not inoculated, they should have had 60 cases with 34 deaths, instead of 11 and 2 respectively: a reduction in case, of 81·7 per cent. and in deaths of 94·1 per cent.

16. *Broach.*—A town of 40,168 inhabitants, situated on the sea-coast 200 miles north of Bombay. Owing to the advent of plague, and consequent flight of many of the inhabitants only 20,000 were found present when a census was taken on 16th March 1899. The average population for the previous six months is estimated by those on the spot at 27,000, and this number is therefore adopted for statistical purposes, in the figures given below, which are taken from a report submitted by Dr. Burjorji Sorabsha, the medical officer employed by the Parsi Panchayat to perform inoculation, among the members of their community. The table below shows at a glance the events in the two sections :—

Population.	Cases.	Deaths.
Inoculated ... 1,970	6 (0·3 %)	4 (0·2 %)
Not inoculated... 25,030	564 (2·2 %)	460 (1·4 %)

If the inoculated had suffered in the same proportion as the uninoculated, they should have had 45 cases with 37 deaths, instead of 6 and 4 respectively: a reduction in cases of 86·7 per cent. and in deaths of 89·2 per cent.

Taking the Parsi community by itself, we find that during the period from October 1898 to March 1899, they numbered on an average 1,843 persons, of whom 1,080 were inoculated. The following occurred :—

Population.	Cases.	Deaths.
Inoculated ... 1,080	2 (0·2 %)	1 (0·1 %)
Not inoculated ... 763	9 (1·2 %)	5 (0·6 %)

If the inoculated Parsis had suffered in the same proportion as those not inoculated, they should have had 12 cases with 7 deaths, instead of 2 and 1 respectively. Inoculation appears therefore to have reduced the number of cases by 83·3 per cent., and the deaths by 71·42 per cent.

Another community which shows striking results from inoculation is that of the tailors of Broach. These numbered 225, and were all living in a camp outside the town, under similar conditions as regards dwellings, mode of living, etc. Of this community 90 were inoculated, and 135 remained uninoculated. The following table shows the incidence of plague in this community :—

Population.				Cases.	Deaths.
Inoculated	...	...	90	0	0
Not inoculated	...	...	135	10 (7·4 %)	6 (4·4 %)

Comment is needless.

From the above observations, then, it may be taken as proved :—

- (a) That inoculation is harmless.
- (b) That when given in the incubation stage (*i.e.*, before the signs of plague are apparent) it has, in many cases, the power of aborting the disease.
- (c) That inoculation affords to all those inoculated a strong protection against attack by plague.
- (d) That in the few cases when inoculated people are attacked a very large proportion recover.

CHAPTER I.

Part V.—The Discretional Relief Fund.

One of the greatest difficulties experienced by Government in dealing with plague was the abhorrence and distrust with which the people regarded plague hospitals. Every means was tried to overcome this prejudice and this unpopularity; private hospitals were permitted, where native practitioners administered native medicines, and patients were absolved from all compulsion in the matter of taking medicines. Their friends and relatives were allowed to visit them, and no effort was spared to clearly prove the humane intentions of Government in the enforcement of this measure. But of all the means devised to render hospitals less unpopular and more attractive, none has been so effective as that introduced in October 1898.

The far-reaching effect of the system then introduced, and the generous grant then bestowed, are of sufficient importance to justify a detailed history of its institution.

The Discretional Relief Fund for Plague was instituted on the 17th of November 1898, by Government Resolution No. $\frac{6406}{6294-P}$ of the 17th November 1898: and detailed instructions as to its disbursement throughout the Presidency are given in Government Resolution No. $\frac{6230}{6328-P}$ of the 14th November 1898, both of which documents are quoted in full below:—

General Department (Plague). No. $\frac{6230}{6328-P}$. *Bombay Castle, 14th November 1898.*

RESOLUTION OF GOVERNMENT.

With a view to encourage the prompt reporting of cases of plague and to facilitate and popularise as far as possible the measures undertaken with the object of reducing mortality during the epidemic, Government are desirous of—

- (1) making the hospitals attractive,
- (2) removing the minor discomforts and losses attendant upon measures of disinfection, etc., and
- (3) removing the objections to temporary removal from an infected house or locality.

If there is any dislike or distrust of hospitals, cases will be concealed and opposition to removal will revive. Large numbers of hospitals have been opened, both by local authorities and by caste committees, and most of them have been well maintained; but at present some lack those attractions which would cause patients and their friends to regard them with gratitude. As the severity of the epidemic increases, the strain on the benevolence of some of the poorer communities intensifies. It is unnecessary here to enumerate the ways in which the sufferings of the poor may be mitigated, but some may be mentioned, as, for example, the provision of extra rations before discharge, the gift of clothing or small sums of money on discharge, the payment of funeral expenses, the support of the family, where necessary, during illness or interruption of ordinary avocations, assistance to survivors or convalescents to return to their homes, and so forth. The popularity of hospitals will be enhanced by fairly generous treatment of the sick and their relations. Occasionally it may be useful to engage or subsidise popular hakims or native practitioners to attend the hospitals. No person who objects should be compelled to take medicines. It will be found sufficient to publish the results in the case of persons who have accepted and persons who have refused treatment.

Concealment of cases is also practised in order to avoid the inconveniences and petty expenses of disinfection, destruction of clothing, etc. Here also much can be done to remove the objections of the poor and to gain at least their acquiescence. Government fear that too little attention has been given to the payment of prompt compensation and to the grant of a

trifling sum to cover, in the case of the working classes, the petty expenses incidental to a temporary vacation of the house. Compensation for articles destroyed or damaged must be paid by the officer on the spot, and may be calculated not only with regard to the value of the article, but also with regard to the cost of replacing it.

The objections to the temporary removal to a camp are usually of a similar nature. The removal involves interruption to work or the loss of wages, or exposure of children to cold, or expenses of transit, and so forth. This is particularly the case with weavers. The officer must make careful inquiry in each case and use his discretion how far to afford relief.

The class of expenditure which has been indicated in the foregoing paragraphs may be described as Discretionary Relief. The Plague Commissioner, subject to the sanction of Government, will place distinct sums from time to time at the disposal of particular officers, Civil or Military. The officer concerned will report weekly the amount spent and the place where he has spent it, and the countersignature of the Plague Commissioner will be accepted by the Accountant-General as a sufficient voucher for the expenditure. Subject to the sanction of Government in each case, the Plague Commissioner may also subsidise any hospital which he is satisfied is in need of such assistance.

In Bombay City the Plague Commissioner is authorised to place a sum at the disposal of the Municipal Commissioner, and elsewhere at the disposal of the Collector of the District, where such assistance appears to the Plague Commissioner to be necessary. The money must be regarded as quite distinct from advances or grants made on account of ordinary plague charges and no funds held on the one account should under any circumstances be used for expenditure on the other. No officer to whom a grant has been made for plague expenditure generally is on any account permitted to disburse from its sums properly debitable to Discretionary Relief, and no outlay on Discretionary Relief is to be incurred from Government funds under any circumstances without a prior grant having been sanctioned by the Plague Commissioner. The names of the officers entrusted with advances for Discretionary Relief and the amount of each advance must be approved by the Plague Commissioner. The sums advanced will be taken into consideration in determining the proportion of plague expenditure to be borne by Government and the amount of aid to be given to Local bodies when the accounts are finally adjusted.

For the due control of this expenditure the Circular and Forms appended to this Resolution, which have been prepared by the Municipal Commissioner, Bombay, and which have been modified to suit requirements elsewhere, are approved. The Forms have been made as simple as possible with a view to minimise the labour involved to the officers concerned while maintaining a record of all that it is necessary to know. The account of the Deputy Commissioner for Plague Operations in Bombay with the Plague Commissioner, and the District Officers' accounts with the Deputy Commissioner, will be kept up in the Chief Accountant's Office in ordinary account form. Elsewhere those accounts will be kept by the Huzúr Deputy Collector. A receipt must be given by every officer for each sum advanced to him. The Plague Commissioner will inform the Accountant-General of every advance made by him and the names of those authorised to receive advances and the amount of the advances allotted in each case. The Plague Commissioner will forward weekly to the Accountant-General one copy of Form C with his countersignature, which will be the voucher for the expenditure.

It is not intended that the necessarily very limited allotment available for Discretionary Relief should replace or dry up private charity. On the contrary, it is hoped that these instructions will stimulate many to come forward to supplement the sums placed at the disposal of officers. It will prove convenient that any officer applying for an advance for Discretionary Relief should state the amount and the principal objects for which he requires it, and how long he thinks it will last. Experience has shown that even small sums judiciously expended are greatly appreciated. The Deputy Commissioner in Bombay, and elsewhere the Collector of the District, will promptly caution any officer whose expenditure appears to be unduly heavy, and will take early steps to satisfy himself whether the distress or the circumstances are so exceptional as to justify the expenditure, and whether the discretion is being wisely exercised.

A copy of this Resolution should be furnished to the Government of India in compliance with the request conveyed in paragraph 2 of their letter No. 4547-A., dated the 15th October 1898, Finance and Commerce Department.

(Sd.) A. WINGATE,

Acting Chief Secretary to Government.

CIRCULAR.

"Small advances will be placed by the Deputy Commissioner, Plague Operations, Bombay,
Collector
at the disposal of certain officers for discretionary relief in cases of distress, etc., connected with plague. This money must be regarded as quite distinct from advances or grants made on account of ordinary plague charges, and no funds held on the one account should under any circumstances be used for expenditure on the other. There must be no outlay whatever without a prior grant having been sanctioned by the Plague Commissioner.

Officers will themselves learn by experience in what direction this relief should be afforded, and they should freely report for orders or for information any instances requiring relief not enumerated below, but as a general guide the following are indicated, provided always that the relief is intended for the poor and the poor only:—

(a) Hospital Relief.

- (1) The provision of extra rations before discharge.

NOTE.—This would ordinarily be arranged under the special direction of the Deputy Commissioner for Plague Operations, Bombay,
Collector

- (2) The gift of clothing or small sums of money on discharge.

- (3) The payment of funeral expenses.

- (4) The support of a family, where necessary, during illness or interruption of ordinary avocations, while in hospital or the hospital camp.

- (5) Assistance to survivors or convalescents to return to their own homes.

(b) Compensation.

- (1) Payment of prompt compensation for destruction of, or damage to, clothing, etc.

- (2) The grant of a trifling sum to cover, in the case of the poorer classes, the petty expenses incidental to the vacation of a house.

NOTE.—Compensation for articles destroyed or damaged must be paid on the spot, and may be calculated not only with regard to the value of the article but also with regard to the cost of replacing it.

(c) Camps.

- (1) Compensation for interruption of work or loss of wages.

- (2) Expenses of transit.

- (3) Provision of warm clothing or a blanket as a protection against the increased cold of camp-life.

- (4) Provision of cots as a protection against dampness. Expenditure under this head (4) must, however, be previously sanctioned by the Deputy Commissioner for Plague Operations as "Discretionary Relief" is intended, as far
Collector

as possible, actually to reach the pockets of the poor.

For each advance received the officer will furnish a receipt. No vouchers will be required from the officers to whom advances from this Discretionary Relief Fund are made, except in case of purchase of supplies, blankets, etc., from tradesmen, when the receipts must be attached to the weekly return. They will, however, be personally responsible that the money is properly expended and that the accounts are correctly and punctually submitted.

It may be impossible for the officer entrusted with an advance to be promptly on the spot in every case where relief is desirable, and these officers are therefore authorized to entrust small sums to those of their volunteers and those of their assistants in whose integrity and discretion they feel that they are able to repose complete confidence. But such advances must not appear in the accounts, and the officer making the advance must exact from such persons a careful record of the information necessary to complete the accounts in

the prescribed form, and any balance remaining with such persons should appear in the accounts in the balance remaining in his own hands, and he must be ready to hold himself personally responsible for it. Each person so entrusted by the officer must keep the same cash book and details as the officer, and the officer must keep a record of any sums so entrusted.

Accounts should be kept in the accompanying sample Form A.*

If the advance runs short during any week it may be recouped on application and on furnishing a receipt to the Deputy Commissioner
Collector. But the detailed account will be furnished only once a week to the Deputy Commissioner
Collector, as provided in the next rule.

A weekly return in the accompanying Form B* should be forwarded to the Chief Accountant
Huzur Deputy Collector, and should be for the week ending 6 A.M. on Saturday.

It should reach the Chief Accountant
Huzur Deputy Collector, on Saturday, if possible, and as soon as possible thereafter the amount spent during the week will be recouped to the officer concerned. If necessity arises, additional advances can be made during the week in anticipation of the submission of accounts. Expenditure will be classified under three heads, as shewn in the Forms—Hospitals, Compensation, Camps.

To avoid confusion, it is directed that where a camp is combined with a hospital, the expenditure should come under the head 'Hospitals.' Camps will include authorized segregation houses.

The Deputy Commissioner
Collector will arrange that the cash book of each officer holding an advance shall be inspected once a week
from time to time, so that he may be in a position to satisfy the Plague Commissioner that the relief money is being expended on the object for which it has been given, that there is no waste, and that due foresight is exercised so that the small available funds may not too rapidly be exhausted.

Form C* will be prepared from Form B, and will be forwarded punctually by the Deputy Commissioner
Collector to the Plague Commissioner in duplicate."

* Form C only has been inserted here. The others are forms dealing merely with details of expenditure.—J. K. C.

C.
Return of Expenses on Discretionary Relief for Week ending

Date.	RECEIPTS.		EXPENDITURE.				
		Rs. a. p.	Disbursing Officer.	Relief in Hospital.	Compensation.	Relief in Camp.	Total.
October 24th.	Opening Balance ...	.....	District Officer, A Ward, Fort and Colaba.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
	Received from Plague Commissioner. }	5,000 0 0	„ B „ Mándvi, etc. ...	120 0 0	35 0 0	50 0 0	205 0 0
			„ C „ „ ...	200 0 0	15 0 0	100 0 0	315 0 0
			„ D „ „ ...	25 0 0	10 0 0	40 0 0	75 0 0
			„ E „ „ ...	.....	5 0 0	175 0 0	180 0 0
			„ F & G „ „ ...	.....	.....	.....	.....
	Total ...	5,000 0 0	* Balance in hand ...	.....	.....	.....	.....
			Total ...	345 0 0	65 0 0	365 0 0	775 0 0
				.....	.....	.....	4,225 0 0
							5,000 0 0

* Includes balances with Disbursing Officer.

I certify that I have received accounts for the sums entered in this statement and have satisfied myself that the money is properly expended.

Date _____ 189 .

Forwarded to the Plague Commissioner.

Signature of the Deputy Commissioner
in Bombay, or of the Collector of
the District elsewhere.

"General Department (Plague). No. $\frac{6294}{6406-r}$.

Bombay Castle, 17th November 1898.

"Letter from the Government of India, Finance and Commerce Department, No. 4547-A., dated the 15th October 1898:—

'In continuation of the telegram * from this Department, dated the 26th September 1898, sanctioning a grant of Rs. 10 lakhs to the Municipality of Bombay, I am directed to say that the Accountant-General, Bombay, will be authorized to place at the disposal of the Municipal Commissioner of Bombay for expenditure independently of the Municipality on plague camps in and near the city, such further sums of money, not exceeding in all one lakh of rupees, as the Government of Bombay may from time to time direct. The Accountant-General will also be authorized to pass expenditure against this grant on receipt of a weekly statement countersigned by the Plague Commissioner, showing the total expenditure incurred. The expenditure will be adjusted in the Government books as expenditure on plague camps by the Municipal Commissioner, for which a sub-head will be opened under the head '24—Medical.'

'2. I am also to sanction a further grant for the whole of the Presidency of three lakhs of rupees for expenditure on 'Discretionary Relief,' to be incurred in the form of grants placed at the disposal of selected officers under the authority of the Government of Bombay. These grants will be accounted for by the spending officers in statement countersigned by the Plague Commissioner and submitted to the Accountant-General. It is understood that the Government of Bombay intend shortly to issue a Resolution laying down the definition of the expenditure and the procedure, and I am to request that a copy of this Resolution may be furnished to the Government of India as early as possible to enable them to communicate further instructions to the Accountant-General.

'3. An additional grant of 4 lakhs of rupees during 1898-99 is sanctioned for the purposes indicated in paragraphs 1 and 2. I am to request that in order to bring the expenditure incurred on the accounts according to the time when it is actually incurred, the sums issued may not take the form of large lump grants, but may be restricted to the amounts likely to be required for expenditure during short periods.

'4. I am further to add that in modification of the orders contained in the letters from this Department, No. 2764-A.C., dated the 21st June 1898, and No. 3183-A.,† dated the 20th July 1898, the Government of India have been pleased to decide that expenditure on account of the salaries, etc., of officers of Government in various departments, including doctors and nurses procured from England, who have been specially deputed wholly or in addition to their own duties to plague duty, should be met after September entirely out of the Government funds, and should not be charged directly upon the funds of Municipalities or Local bodies. The Accountant-General will be instructed to adjust the expenditure in the Government books under appropriate heads.

'5. Lastly, I am to explain that the orders issued in this letter are meant to be independent of the consideration of the ultimate distribution of the expenditure between General and Local and Municipal funds. The sum now sanctioned in paragraph 3 and the expenditure incurred under paragraph 4 will be taken into consideration in determining the proportion of plague expenditure to be borne by Government and the amount of aid to be given to Local Bodies when the accounts referred to in the Government of India's letter of 22nd August are finally made up.'

Memorandum from the Financial Department of the Secretariat, No. 5028, dated the 2nd November 1898—

Forwards the above.

RESOLUTION.—The attention of the Municipal Commissioner for the City of Bombay should be invited to paragraph 1 of the letter from the Government of India and he should be asked to note the request made by that Government in their paragraph 3. Very great importance is attached to the evacuation, for longer or shorter periods according to circumstances, of infected houses and localities, but it is not intended that the whole of the one lakh of rupees should be expended at once. The Municipal Commissioner should report what

* *Vide* Government Resolution, General Department, No. 5799, dated the 18th October 1898.

† Embodied in the preamble of Government Resolution, Financial Department, No. 3834, dated the 26th August 1898.

expenditure he considers immediately necessary or desirable on camps in and near the city, and a sum of money will be allotted for the purpose. Further application can be made as necessity arises. The actual amount expended each week should be reported to the Plague Commissioner on a bill for countersignature by the Plague Commissioner, supported by the necessary vouchers and by certificates that the rates have been examined and that the expenditure has been incurred.

For the regulation of the expenditure on Discretionary Relief a separate Resolution, No. 6230—6328-P., dated the 14th instant, has been issued, and it is only necessary to note here that of the total grant of three lakhs of rupees, one and a half lakhs are being reserved provisionally for the City of Bombay, the rest being made available for the Presidency proper.

In respect of paragraph 4 of the Government of India letter, it is only necessary to explain that the officers intended are those belonging to the Indian Civil Service, the Indian Staff Corps, the Indian Medical Service, the Royal Army Medical Corps, and the superior (*i. e.*, gazetted) officers of the Forest, Survey, Customs, Salt and other Departments, including doctors and nurses procured from England. Apparently pay-bills for September payable on the 1st October would be debitable to Government, and the Accountant-General should be asked to state whether this is admissible.

His Excellency the Governor in Council desires cordially to acknowledge the particular assistance which the Government of India have been pleased to grant in anticipation of the whole case of the financial position of the Local bodies being laid before them. Government desire to express their regret that owing to the delay in the receipt of reports, they have been unable as yet to give the Government of India the information needed, and they desire again to call special attention to the circular of the General Department, No. 5085, dated the 10th September 1893. Each officer to whom that circular was addressed will intimate at once the date on which he expects to be able to despatch his report in regard to each Municipality or Local Board, in respect of which his report has not yet been furnished. Collectors will be good enough to remember that any further delay will cause very great inconvenience to His Excellency the Governor in Council and to the Government of India, who are anxious that the settlement of accounts in respect of past operations should not be longer delayed.

(Sd.) A. WINGATE,

Acting Chief Secretary to Government."

It will be seen from the above documents that the control of this large fund was vested solely in the Plague Commissioner, who was directly responsible to Government for its proper and judicious disbursement.

The enormous amount of good that can be done by the wise expenditure of such a fund, affecting, as it does, the entire Presidency, can with difficulty be realised: the amount expended in thousands of cases being out of all proportion to the happiness conferred. The thousands of sufferers, who have, by its means, been tended by relative or friend; the still larger number of such sufferers to whom it has afforded comforts and luxuries, un hoped for and otherwise unattainable; the thousands of mourners who have by it been enabled to give to their nearest and dearest a funeral in harmony with their feelings and their creed; and the numbers whom on recovery it has saved from starvation and misery, all testify to the incalculable good it has done, the vast influence it has exerted. It may even be said that to it is due the fact that the distrust and hatred of plague hospitals is to-day a thing of the past.

Besides the methods of relief above mentioned, which more particularly influenced the people's attitude towards *hospitals*, other methods of using it have had in a *general* way perhaps as great an effect. Amongst such methods may be mentioned—

(1) Compensation, (2) subsistence allowance, etc.; these terms being comprehensive and more fully described below.

(1) *Compensation.*—This might be of various sorts, *i. e.*, for clothing destroyed, for bedding burnt or for damage sustained to property by disinfection. Thus a patient's clothing or bedding, on admission to hospital, may be burnt as suspicious. The man is provided in consequence with new clothes or new bedding, the amount being of course disproportionate to the intrinsic value of the articles replaced.

If by disinfection, removal, etc., a poor man's house or property sustains any damage of any kind, compensation is invariably given to make good such damage,

(2) *Subsistence allowance.*—This is granted when the supporter or bread-winner of a family is attacked by plague and removed to hospital; for instance, in cases of weavers, workmen, and labourers, in general, attacked, who are obliged to work hard all day for a scanty pittance, and who invariably have a large number of relatives depending on them, a daily allowance, generally equal to that which they ordinarily earn, is made over to their families or dependants as the case may be, till such time as it takes them to get cured of the disease and resume their places as bread-winner.

(Instances of compensation, etc., are given on pages 96 and 97 of the Municipal Commissioner's Report for 1898-99.)

The actual grants allotted, together with the amounts expended, and the balance remaining, are given District by District below :—

Total Expenditure on Discretionary Relief (by Districts) from its institution in November 1898 to the 27th May 1899.

Locality.	Total amount received.	Total amount expended.	Balance on 2nd June 1899.	Details of Expenditure.		
				Relief in Hospital.	Compensation.	Relief in Camp.
1	2	3	4	5	6	7
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Bombay City	60,000 0 0	50,498 15 4	9,501 0 8	12,553 3 3	21,788 4 0	16,157 8 1
Belgaum... ..	5,083 7 10	4,083 7 10	1,003 0 0	216 14 9	844 3 9	3,022 5 4
Bijapur	300 0 0	261 3 9	38 12 3	2 3 10	93 13 0	165 2 11
Broach	640 0 0	148 12 0	* 491 4 0	31 0 0	39 4 0	78 8 0
Dharwar	4,850 0 0	3,810 4 4	1,039 11 0	11 7 10	867 0 0	2,831 12 5
Hyderabad	300 0 0	123 3 6	166 12 6	17 12 1	51 0 0	64 7 6
Kaira	200 0 0	87 11 5	112 4 7	21 3 4	.....	66 8 1
Karachi	750 0 0	469 8 0	280 8 0	205 14 9	198 14 0	154 11 3
Kolaba	180 0 0	39 14 0	† 140 2 0	13 0 0	16 2 0	10 12 0
Panch Mahals	200 0 0	200 0 0	.....	.....	.....	200 0 0
Poona	1,400 0 0	1,088 13 6	311 2 6	289 9 6	577 6 0	221 14 0
Ratnagiri	200 0 0	81 0 0	119 0 0	.....	30 0 0	51 0 0
Satara	800 0 0	715 6 0	84 10 0	112 4 0	57 2 0	546 0 0
Sholapur... ..	150 0 0	35 0 0	115 0 0	4 0 0	.....	31 0 0
Surat	300 0 0	25 8 0	274 8 0	.....	10 8 0	15 0 0
Thana	240 0 0	53 4 0	186 12 0	28 4 0	13 3 0	11 13 0
	75,593 7 10	1,731 15 8	13,861 8 2	13,606 13 4	24,496 11 9	23,628 6 7

* Refunded Rs. 421-8-0.

† Refunded Rs. 100-0-0.

CHAPTER I.

Part VI.—The Mortality of Plague.

Whether looked at from the standpoint of the number of people it destroys when it appears, or from the standpoint of the number of those attacked by it who ultimately succumb, plague is acknowledged to be the most deadly of all known diseases. Mild in some of its forms, it is in others exceedingly fatal.

“The prognosis of plague,” says Dr. Lyons, “is always exceedingly grave ; as it is the most fatal of all known epidemic diseases.”

The following instances of case-mortality in hospitals are taken from various sources :—

Place.	Time.	Cases.	Deaths.	Percentage Mortality of Cases
Bombay City...	Sept. and Oct. 1896	...	...	Between 95 and 99 %||
	November 1896	...	...	Between 85 and 90 %||
	1896-97	1,579	1,098	69·54
	Before June 1897	2,646	1,561	58·9
	1897-98	8,114	5,336	65·7
	1898-99	10,210	7,519	73·6
Poona	Before June 1897	1,130	757	67·0
	1897-98	4,138	2,836*	64·1*
	1898-99	614	419†	69·95†
Sind ...	Sheth Vishindan Hospital.	448	302	67·40
	Transhyari Hospital.	394	249‡	63·35‡
	Other Sind Hospital.	178	105§	65·62§
	Mandvi Plague Hospital.	1,981	1,376	69·4
Cutch	Cutch Plague Hospital.	417	303	72·6
Bulsar Plague Hospital ..	1898-99	360	220	61·1
Nasik Town Plague Hospital	1897-98	486	397	81·68
Panchwati and Trimbak Plague Hospital.	1897-98	296	208	70·27
Ankleshwar Plague Hospital	1898-99	235	141	60·0
Bhor Plague Hospital	1898-99	204	123	60·2
Kolaba Plague Hospital	1898-99	166	122	73·49
TOTAL	.....	33,596	23,072	68·67

* 33 cases remained over, the results of which are not known.

† 15 cases unaccounted for. ‡ 1 case unaccounted for. § 18 cases unaccounted for.

|| Dr. Viegas' estimate quoted in Major Lyons' Report.

As regards the mortality in Bombay Hospitals, the following remarks by Lieut.-Col. J. S. Wilkins are quoted from the Municipal Commissioner's Plague Report, 1898-99 :—

“It will be inferred from a comparison of the above figures that each recurring epidemic of plague is more virulent than the last. This is an opinion very largely held by medical men in Bombay. It is doubtful, however, if the true increase in percentage mortality

is so great as these figures would lead us to infer. For instance, General Gatacre's Report does not cover the whole of the epidemic of 1896-97, but only deals with four months, during which it was declining; so that the 58·9 per cent. mortality shown by his figures would probably have been much higher if a longer period had been reported on.

"The figures, however, do show a larger number of cases admitted to hospital during 1898-99 than in the previous epidemics. This will be readily seen if we compare the average monthly admissions to hospital. During General Gatacre's time the average monthly admission rate was 661·5; during the existence of the Plague Committee, 811·4, and during the year under report, 850·8.

"It may also be gathered from a comparison of the percentage rates of mortality that the Medical Service is as helpless as ever as far as the treatment of plague is concerned."

It must be noted that the foregoing statement gives the case-mortality for *hospitals only*. In these it may be reasonably inferred that many lives were saved which would otherwise have been lost. It may also be reasonably inferred that the case-mortality in *untreated* cases is higher: although the case-mortality shown by the officially recorded cases and deaths in Districts cannot be accepted as an accurate index of the deadliness of plague. Facts and figures, as far as they are known, or as far as they are available, the accuracy of which has been attempted, but cannot be asserted, are given: the rest must be left to individual opinion. For the great variation in the hospital percentages no satisfactory explanation is forthcoming. Their accuracy is, moreover, in some cases vitiated by a number of cases remaining over, the developments of which would naturally affect the results.

Taking into account all these considerations, the case-mortality of plague in hospitals during the past 3 years may be roughly estimated to lie between 65 and 75 %; or still more roughly at about 70%. But the mortality in pneumonic and septicæmic cases must be placed a good deal above, and in simple bubonic cases, perhaps, a little below, this estimate.*

No such estimate can even be hazarded of the mortality of plague *outside* hospitals. From Panvel and Kambhala, where practically every case proved fatal, to Dharwar and Sholapur Districts, where the officially recorded case-mortality was over 80%; and from these again to Panch Mahals, where it was only about 70 %; and from Panch Mahals again to Bantwa and other places where it was under 60 %, stretches a field of possible percentage mortalities, in which the true average plague mortality lies; but the location of the latter cannot at present be determined.

A comparison of the actual total mortality throughout the Presidency during the 3 plague years, with the average normal mortality of 3 years previous to plague, elicits curious results. Thus in Ahmedabad District, where there has been little or no plague, the mortality for the 3 plague years is over 12,000 less than in 3 normal previous years; in Ahmednagar, *where 1,000 deaths have been reported from plague*, the mortality during the 3 plague years is over 9,000 less than in 3 normal years previous to plague; Hyderabad (Sind), Kaira, Surat *all show a similar decrease, in spite of a positive plague mortality*. Satara District, in which 20,000 deaths are accredited to plague, shows, nevertheless, nearly an average mortality. On the other hand, Sholapur, Shikarpur, Ratnagiri, Nasik, Kolaba, Kanara and Bijapur Districts return an increased mortality utterly disproportionate to their reported plague.† There are those who assert that, by subtracting the average mortality during normal years from the actual mortality during plague years, the true plague mortality can be arrived at. With what limitations, in the face of such bewildering figures as these, this universality is to be comprehended, who shall inform us?

A statement of the actual and average mortality in Districts and Agencies, as far as it can be ascertained, is attached.

* Compare Dr. Lyons' remarks on page 80.

† This state of affairs seems to support the contention of the various Sanitary Commissioners throughout India that death registration outside Municipal areas and in rural districts is still extremely defective in ordinary years.

Statement comparing the total mortality for 3 normal years previous to plague, with the total actual mortality for the 3 plague years : and shewing case-mortality percentages.

Locality.	Population in 1891.	Total up to 1st September 1899.		Case-mortality percentages.	Total actual mortality for 3 normal years previous to plague.*	Total actual mortality for the 3 plague years.
		Cases.	Deaths.			
Ahmedabad District	921,712	191	115	60·20	93,221	79,771
Abmednagar „ ..	888,755	1,897	1,447	76·27	96,175	86,891
Belgaum „ ..	1,013,261	31,656	23,803	75·18	83,799	120,351
Bijapur „ ..	796,339	3,002	2,414	79·98	63,933	71,625
Bombay City ..	806,144	50,457	43,636	86·48	80,541†	159,550†
Broach District ...	341,490	1,676	1,250	74·58	35,620	39,505
Cutch State	558,415	10,888‡	8,962‡	82·31	17,694	22,558
Dharwar District ..	1,051,314	39,717	32,063	80·78	89,344	141,109
Hyderabad „ ..	918,646	851	657	77·20	39,848	35,198
Kaira „ ...	871,589	2,429	1,841	75·78	89,660	79,195
Kanara „ ...	446,453	459	326	71·02	36,226	41,217
Karachi „ ...	564,880	11,301	8,720	77·16	31,770	48,068
Kathiawar State ...	2,752,404	2,438	1,705	70·34§§
Khandesh District ...	1,460,851	1,157	909	78·56	142,113	162,997
Kolaba „ ...	594,872	3,263	2,781	85·22	42,175	55,884
Kolhapur & S. M. C. Agency.	1,562,929	21,107	15,953	75·58	88,107||	115,422||
Nasik District ...	843,582	8,688	6,658	76·63	87,474	109,480
Palanpur State¹ ...	283,319	1,906	1,257	65·95§§
Panch Mahals District	313,417	1,245	889	71·41	22,032	24,388
Poona „ ..	1,067,800	27,373	20,819	76·06	96,423	122,557
Ratnagiri „ ...	1,105,926	1,197	984	82·21	71,159	79,072
Satara „ ...	1,225,989	28,957	22,667	78·28	107,333	108,261
Savantvadi State ...	192,948	61	44	72·13	8,575¶	10,130¶
Shikarpur District ...	915,497	995	699	70·25	53,937	64,075
Sholapur „ ..	750,689	5,233	4,276	80·94	71,598	103,636
Surat „ ...	649,989	8,804	6,499	73·82	69,705	69,269
Thana „ ...	819,580	13,919	10,763	77·32	59,607	83,161
Totals..	.....	280,917	222,137	79·08	1,678,069	2,033,370

* Years in which epidemics have caused an abnormal mortality have been excluded from these figures.

† Figures taken from the Municipal Commissioner's Annual Report, 1898-99.

‡ Accuracy of these figures not established.

§ Figures for Kathiawar and Palanpur are not known.

¶ The figures for Kolhapur, Miraj [Junior], Jamkhadi, and Ramdurg States are for 2 years only.

¹ For 2 years only.

As regards the plague mortality in Bombay City, the following quotations are made: the first from the Municipal Commissioner, Mr. W. L. Harvey's Report for 1898-99, page 11; and the second from Couchman's Report for 1896-97, page 88:—

(1)

"Except a brief outbreak of cholera at the beginning of the monsoon of 1897, no other epidemic of serious importance has appeared in the city during the past three years. The line of general mortality may therefore be taken as a safe index to the rise and fall of plague."

(2)

"The figures of the actual excess of the total mortality over the average do not by themselves give an entirely accurate idea of the plague mortality. On 2nd March when the Committee were appointed, the population of the city was only about 467,000; whereas the figures for average mortality are based on the census population of 821,000. If account were taken of the reduced population, the normal mortality would be found to be considerably less than that shown in column 3 of the above statement, and the difference therefore between the actual and the normal figures would be greater than that shown in column 4. In the absence of any other epidemic in the city, this difference may be said to represent approximately the plague mortality in the city. In view of the constantly changing figures of population an accurate estimate of this difference cannot be made, but a rough calculation shows that the deaths from plague from September 1896 down to the end of June were between 25,000 and 30,000."

As regards the plague mortality in Poona City, the following quotation is made from Couchman's Report for 1896-97, pages 97 and 98:—

"The steady decrease in the mortality is shown in the following table:—

Period.				Plague Deaths reported.	Total Mortality.
March	1-10	...	...	202	615
"	10-20 *	...	...	241	517
"	21-31 *	...	...	313	524
April	1-10	...	...	218	328
"	11-20	...	...	132	206
"	21-30	...	...	66	109
May	1-10	...	...	22	59
"	11-20	...	...	16	53

As regards the actual mortality which had taken place from plague, Mr. Rand points out that the recorded figures of plague cases are little guide, as in the early period no attempt at securing accurate returns had been made by the Municipality. He gives the following table from which an approximate estimate can be obtained of the true plague mortality. The population of Poona City is 118,790 with a density of 24,242 persons to the square mile:—

Month.				Quinquennial average.	Actual.	Difference.
December	...	...	...	261	270	9
January	...	...	...	261	497	236
February	...	...	...	225	1,009	784
March	...	...	...	244	1,656	1,412
April 1st to 20th	...	...	...	178	534	356
Add—Reported plague deaths down to May 20th from April 21st				.....	.....	104
Total estimated Plague Mortality						2,901 "

* Plague Committee's operations began on a small scale on March 13th, but the number of parties was increased on March 29th.

CHAPTER I.

Part VII.—The Duration of Plague Epidemics.

The question of how long an epidemic of plague lasts is one of exceeding difficulty. Leaving for the moment out of account such circumstances as the long period of dropping or sporadic cases which may either precede or follow an epidemic, or again the total cessation of the disease for a week or two in the very midst of an epidemic, for the great variation in the actual duration of plague, even in places similar both as regards size, climate, and general surroundings, no adequate reason can be assigned. And it is with extreme caution that even the law of average itself must be applied. In the present note, therefore, the facts and figures are stated with almost bald simplicity; little having been attempted beyond the mere collation of the figures.

(a) *Period of freedom from plague in Bombay Presidency as a whole, in Divisions and in Agencies, since first infection in each case.*

Taking Division by Division, District by District, city by city, town by town, and village by village, the results are given categorically below.

The duration of plague in Divisions and Agencies has been so continuous that it can best be emphasized by marking the periods of freedom. They are shown in the following table:—

Bombay Presidency as a whole.	Northern Division.	Central Division.	Southern Division.	Sind.	Cutch.	Kathiawar.	Kolhapur and S. M. C.	
No single week free from plague since first infection.	Free for 3 weeks in Nov- ember 1896.	Not known, probably 3 weeks.	No free- dom since first infection.	Free, for 4 weeks in Oc- tober 1897, and 3 in March 1898, and for the months of August and September 1897 and February 1898.	Free for week ending 5th March 1897 only.	Free for weeks end- ing 25th March, and 23rd Dec 1898; and 24th March 28th April and 2nd June 1899; for two weeks in June 1897; for 2 in April 1898 and for 3 in May 1899, and for the months of July, Aug., Sept., Oct., Nov., and Dec. 1897.	Free for weeks ending 28th May, 20th Aug. & 24th Sept. 1897 and 2nd June 1899; and for 2 weeks in April, 2 in June, 2 in July and 2 in Oct. 1897.	
Total aggre- gate freedom.	<i>Nil.</i>	3 weeks.	Probably 3 weeks.	<i>Nil.</i>	20 weeks.	1 week.	39 weeks.	12 weeks.

It is not necessary in the case of Districts to give a tabular statement. Appendices A, B, C, etc., show clearly the duration of plague in them; and a reference to these appendices shows at a glance that the periods of freedom in Districts are both more frequent and more lengthy than those in Divisions. Thana and Kolaba are exceptions; but their case is easy to explain. Close proximity to Bombay City, constant and intense intercourse with it maintained by every possible means, fairly account for their almost uninterrupted infection.

Taking now the largest cities in the Presidency, the results are as follows :—

(b) *Duration of plague and intervals of freedom in large cities.*

	Bombay City.	Poona City.	Surat City.	Karachi City.
	819,000	161,390	109,229	98,195
	Constantly infected since September 1896. Longest period of cessation, two days.	Continuously affected except for one week in June 1897; one in April 1898; 2 in May 1898; 3 in June 1898; 3 in July 1898; 2 in Nov. 1898; one in January in February 1899.	Free for one week in December 1896; 2 weeks in May 1897; 3 in July, 1 in Aug. 1897; 3 weeks in May 1898, two in July, two in August, 3 in September, 3 in November and 4 in December, 1898; one week in January 1899, 3 in February, 1 in March, 2 in April, 2 in May, 1 in June 1899, and for the months of June 1897 and June Oct. 1898.	Free for 3 weeks in March 1898; one in December 1898; and for the months of August, September, October, November and December 1897, and January and February 1898.
Total aggregate freedom.	Nil.	14 weeks.	46 weeks.	35 weeks.

It will be seen that the Bombay Presidency, as a whole, and Bombay City alone since first infection, have never been free from plague. The first follows as a natural consequence of the second. But the explanation of the second is not easy, although several plausible reasons might be adduced. This City is, as it were, the heart and brain of the Presidency. Radiation, whether of people or goods, is from, and aggregation is to, it: in it, therefore, some of the germs of a disease so widespread as plague-germs—scattered broadcast over the Presidency—might at any and every time be reasonably expected to be found (either present or imported),

A difficulty now arises in the further subdivision of places. There is no town in the Presidency with a population between 62,000 (Sholapur) and 100,000 (Karachi). On the other hand there is a large number of towns with populations varying from 60,000 to 20,000: and these have been massed together in the next category. It is in the case of these towns both useless and unprofitable to dwell on their periods of freedom; the duration and number of their epidemics are therefore alone considered below :—

(c) *Duration of plague in towns with a population of between 60,000 and 20,000.*

Town.	Population.	Approximate durations of		
		1st Epidemic.	2nd Epidemic.	3rd Epidemic.
Sholapur *	62,329	22 weeks.	...	...
Hyderabad	58,048	13 "	...	...
Hubli †	52,194	30 "	...	...
Broach	40,137	16 "	...	...
Mandvi	38,155	† 20 "	25 weeks.	18 weeks.
Ahmednagar *	36,031	15 "	...	...
Dharwar	32,533	15 "	...	...
Sukkur	29,302	10 "	...	...
Belgaum	28,342	13 "	24 weeks.	...
Miraj	26,060	13 "	...	...
Satara	25,748	16 "	...	...
Nasik	24,406	14 "	18 weeks.	...
Gadag	23,821	15 "	...	...
Palanpur	21,092	10 "	13 weeks.	...

* Epidemic shortened by evacuation.

† Phenomenal.

‡ No measures: epidemic exceedingly severe.

The average duration of plague in towns between 20,000 and 60,000 appears to be therefore between 15 and 18 weeks—or about 4 months. The effect of evacuation, the phenomenal outbreak at Hubli, and want of measures in Mandvi, etc., combine to render the figures less definite than they would otherwise be.

Places with a population of under 20,000 still remain to be dealt with. The variations in the duration of plague in these places, even when situated in the same District, and administered by the same officers, render it necessary again to resort to subdivision.

In the next category, therefore, towns of from 20,000 to 7,000 are alone included. But the number of such towns is so large that it is necessary to treat them aggregately by Districts.

(d) Duration of plague in towns with a population of between 20,000 and 7,000.

District.	Number of places (20,000—7,000) affected.	Total aggregate duration of plague (in weeks).	Average duration (in weeks).
Thana District	9	131	14 ⁵ / ₉
Surat „	4	51	12 ³ / ₄
Satara „	3	40	13 ¹ / ₃
Kathiawar Agency	3	44	14 ² / ₃
Other Districts	15	167	11 ² / ₅
Total	34	433	12 ² / ₃ ⁵ / ₄

In places with a population of under 7,000 the duration of an epidemic appears to be limited to a few weeks. The results in the case of these latter obtained by the same method as statement (d) are given in the following statement :—

(e) Duration of plague in towns and villages with a population of 7,000 and under.

District.	Number of places (7,000 and under) affected.	Total aggregate duration of plague (in weeks).	Average (in weeks).
Bijapur District	51	293	5 ² / ₅ ¹ / ₁
Thana „	42	359	8 ² / ₂ ³ / ₂
Dharwar „	40	299	7 ¹ / ₄ ⁹ / ₀
Surat „	39	316	8 ⁶ / ₃ ⁴ / ₃
Cutch State	32	316	9 ⁷ / ₈
Belgaum District	28	240	8 ⁴ / ₇
Kolaba „	26	203	7 ² / ₂ ¹ / ₆
Ahmednagar,,	23	147	6 ⁹ / ₂ ⁸ / ₃
Kaira „	22	79	3 ¹ / ₂ ⁹ / ₂
Broach „	16	51	3 ¹ / ₁ ³ / ₆
Other Districts	25	165	6 ³ / ₅
Total	344	2,468	7 ¹ / ₅ ⁵ / ₈

A comparison of all these statements appears to show that the duration of plague is to some extent dependent on the area and population of the place affected.

In order to obtain information on the general question of the continuance of plague in a place, the following Circular was issued by the Plague Commissioner on the 15th of August 1898 :—

Circular.

“When plague ceases for several months in a town, or village, or house, is the germ dead or is it merely dormant? This is a point on which it is important to collect evidence. And the Plague Commissioner will be glad to have any that there may be already, or that may in future come to notice. And he requests that a look-out may be kept for facts bearing on the point. To what extent is it found that in the present, or past, spreads of plague the disease keeps re-appearing in the same villages and in the same houses, as though the result not of new imported infection, but of the re-awakening of a germ that has never quitted the room.

(Sd.) A. CUMINE,

Acting Plague Commissioner.”

Replies to this Circular were received from Ahmednagar, Kathiawar, Khandesh, Satara, Sholapur and other places ; but they were all inconclusive.

CHAPTER II.

THE MEDICAL ASPECTS OF PLAGUE.

REPORT OF THE BOMBAY BUBONIC PLAGUE RESEARCH COMMITTEE.

(NOTE.—Footnotes made by Major Lyons are not initialled : in every other case the initials of the annotator are given.)

The Plague Research Committee, details of the constitution and work of which are given below, was a body of experts appointed by Government to investigate and report upon the nature and treatment of Plague. Owing to their ordinary duties, however (Major Manser was Professor of Medicine, and Capt. Childe Professor of Pathology at the Grant Medical College, Bombay), they were unable to give the time and research to the subject which could have been wished : but in this statement Mr. Haffkine and Mr. Hankin are not included.

Nevertheless, in spite of difficulties in the matters of time and opportunity, they, after the lapse of a year, published a Report of remarkable excellence on the clinical aspects and the macroscopic and microscopic pathology of the disease ; as well as the results of various investigations and experiments in the bacteriology of the subject.

At the present time, indeed, except in the bacteriology of the subject, their Report still stands as the first authority on the medical aspects of Plague, and for that reason it is quoted, practically *in extenso*, here.

Owing to the length of the Report, it has been found necessary to omit portions, but in every case where this has been done, the fact, with a description of the portion omitted, has been stated.

The history of the Committee itself was an eventful one. Appointed in October 1896, its President, Major Manser, succumbed to plague within the first three months of its existence, while Dr. Surveyor's health gave way. A full description of Major Manser's case is given in the Report itself by Captain (now Major) L. F. Childe, I. M. S., who attended him.

After Major Manser's decease, Major Lyons, I. M. S., was appointed President.

Points of special interest are the failure to find the point of entry of the poison into the body marked by any specific lesion, such as is the case in anthrax ; the character of the gland enlargement and the effusion into the tissues surrounding the glands, which is so conspicuous and forms such a mass that the glands proper are almost entirely obscured by it ; the brain appearances of congestion, etc., which may perhaps explain the cerebral symptoms ; and, lastly, the state of the heart, which is of great interest.

I.—REPORT BY SURGEON-MAJOR LYONS, I. M. S., PRESIDENT OF THE PLAGUE RESEARCH COMMITTEE.

THE Plague Research Committee was originally formed, in October 1896, to inquire into the nature and history of the disease, stated to be bubonic plague, of which a number of cases had occurred in Bombay City.

The Committee was composed of the following members, and they decided to distribute the work as follows :—

SURG.-MAJOR MANSER, President:—The clinical aspect of the disease ; its treatment by drugs ; the source of the Bombay outbreak ; the history of its introduction and spread ; and the evidence relating to its incubation period. Dr. Manser died in January 1897 from plague, and Surgeon-Major R. W. S. Lyons took his place as President.

SURG.-CAPT. CHILDE:—The macroscopic and microscopic pathology of the disease.

MR. HANKIN :—Its origin in the outside world ; search for the microbe in food, clothing, bedding, drains and sea-water ; and whether the microbes survived longer in rotten than sound grain.

DR. SURVEYOR :—The nature of the disease in rats and fowls ; bacteriological proof that rats are suffering from the disease ; the effects of antiseptics on the microbe, and the relative value of different antiseptics practically.

MR. HAFFKINE :—The study of the microbe and its relation to the patient and to the animal body ; the question of its communicability by infection or contagion between man and man, and between man and animals, inoculations, etc. ; diagnostic methods ; the period during which the patient continues infectious ; immunity ; and antitoxine and other treatment.

Dr. Surveyor was unable, owing to illness, to pursue his line of investigation or to write a report. Mr. Haffkine's report was not ready for publication with the Committee's report, which was presented to Government in November 1897.

The members of the Committee examined and reported on a very large number of specimens from suspected plague cases sent from every part of India ; experimented with numerous antiseptics sent for report ; and answered an immense number of inquiries addressed to them ; involving tedious laboratory work and a considerable amount of correspondence.

The difficulties of laboratory research were very great, owing to want of apparatus and of trained and intelligent assistants to carry out the ordinary routine work.

The portions of the programme which devolved on Drs. Lyons and Childe had to be carried out at such times as they could spare from their other duties, which, owing to the presence of the epidemic, were unusually heavy.

In the present outbreak of plague the infection was no doubt imported from some locality in which the disease existed, but the most searching inquiry, instituted at the time it was first noticed, failed to discover evidence of plague cases (or indeed of any severe form of sickness except twelve cases of cholera) on board vessels which entered Bombay Harbour after 1st June 1896.

Inquiry was also instituted among ship-owners regarding any noticeable mortality among rats on ships trading with China and ports where plague was known to have existed, but in this case also with negative results. As the outbreak commenced near the Docks, it appears most probable that the infection was introduced by sea and carried in their clothes or goods by traders* who were themselves insusceptible. It is also possible that it may have been introduced in this way by traders from Northern India, as plague is believed to be endemic on the southern slopes of the Himalayas.†

The disease probably commenced to spread in Bombay about the beginning of August 1896, as the mortality of the city began to increase in the second week of that month. This increase in mortality was attributed at the time to remittent fever and lung affections, but as rats were dying in great numbers in Mandvi Ward, where the death-rate among the population was unusually high, and where the prevalence of the epidemic was first discovered, there can be little doubt that the excessive mortality was due to plague. The epidemic spread slowly, and the total mortality continued to increase until by the second week in February the whole city had become infected. After that time the mortality began to decrease, and by the end of May it had fallen to the normal, and deaths from plague ceased to occur.

* Dr. Jan Mahomed's first cases occurred towards the end of September among Mooltaris who trade with China, and who lived near the dock.

† *Vide* Paper on Plague in Gahrwal and Kumaon, by Col. Hutcheson, I. M. S., in the Transactions of the Indian Medical Congress, 1894, Calcutta.—W. B. B.

The official returns of deaths from plague were for various reasons not very accurate. A fairly correct estimate of the mortality can be obtained, however, by taking as plague mortality the difference between the weekly mortality and the mean of the corresponding weeks during the preceding five years, as there was no other unusual cause of sickness present.

It must be remembered that the average weekly mortality during the preceding five years was taken on a population of 800,000, and that owing to the exodus which occurred after the outbreak of the epidemic the population was reduced by from a fourth to a third of that number. The true incidence of the disease was consequently considerably heavier during the later weeks than shown in the table, and this error was a gradually increasing one growing with the decrease of the population.

It has been stated that in other places outbreaks were often preceded by the appearance of cases of painless buboes unaccompanied by vomiting, fever, headache or other symptoms of plague, but this was not observed in Bombay.

It may here be noted that the great difficulty which arises in tracing the mode of infection and the course of plague, as compared with the other more common infectious diseases, is due to two facts—*viz.*, that animals such as rats readily contract and afterwards spread the disease, and that the microbe is capable of thriving and multiplying outside the animal body, as is seen, for example, when it is cultivated in broth or on *ghee*. It is evident that infection may be carried by rats to persons who have never been brought into contact with plague patients, nor with persons visiting plague patients, and whose food and clothing could not have been contaminated in any other way. On the other hand, the germs may be conveyed by persons who are themselves insusceptible to plague, and having grown and multiplied on suitable media and under favourable conditions, may infect large numbers of people who have never come into contact with plague patients, their attendants or plague-stricken rats.

The development of plague in an epidemic form was believed by many persons to be due to rotten grain which had been buried underground, and, it was thought by some, infected with plague germs. Had rotten or diseased grain been sold as food (and there was no evidence that this took place), it would in all probability have given rise to digestive disorders, and in so far have predisposed to plague; but if the grain had been infected with plague bacilli, the disease would have appeared in several localities simultaneously, wherever the infected grain had been eaten. It is impossible to believe too that large stores of infected grain could have been sold without giving rise to an outbreak of disease among grain-sellers throughout Bombay. It is well known that this spreading of the disease far and wide among grain-dealers did not occur, and the 54 grain and flour-sellers, millers, and grain-parchers who died from plague between the months of September 1896 and January 1897, died principally in infected localities in the neighbourhood of the Docks, where the disease first appeared, but did not themselves form centres from which the disease spread in unaffected districts.

The epidemic was observed to increase notably during the cold season and to decline during the hot weather. This increase during the cold months was probably due, to a great extent, to the sick and healthy occupying the same rooms during the day and sleeping together at night, and also to the depressing effects of cold. During the warm months the poor live under much more sanitary conditions than in the cold season.

The influence of animals in spreading the disease was, with the exception of rats, probably inappreciable. A searching inquiry at Damaun, where there were great numbers of pigs at large in the streets, elicited no evidence of a single death, or even of an appearance of sickness among pigs, although an exceptionally severe epidemic of plague had visited

the town. Sheep, goats, horses and cows were unaffected. There was evidence (*post-mortem*) of a dog having been affected, but none that cats contracted the disease. Birds were not at all affected.

In the epidemic at Hardwar, monkeys were infected and died in considerable numbers. The grey monkey is very susceptible to plague and rarely recovers; the brown monkey is much less severely affected.

The influence of ants and bugs in spreading the disease was considered by Mr. Hankin to be unimportant.

All observers up to the present time have connected the occurrence and diffusion of the disease with want and filth, and there seems to be no doubt that these factors do favour it in so far as they lower the general health and diminish natural immunity. But it will be seen that filth *per se* has but little influence, from the fact that there occurred in the House of Correction, Byculla, where cleanliness is brought as nearly to perfection as is attainable, an outbreak which exceeded in severity that in any of the filthy chawls and tenements around. There were 345 prisoners confined in this jail when plague broke out there on the 23rd January 1897; the outbreak lasted for 15 days, and in that time 33 prisoners were attacked, 17 of whom died. It is a significant fact, too, in this connection, that out of 1,579 patients treated at the Arthur Road and Parel Hospitals there were only 16 sweepers, and that the *halalcoores* who remove the night-soil from the houses, and who form probably the dirtiest portion of the population, were notably free from plague. It is true they are a strong well-nourished class, of whom only the fittest have survived, and they are highly paid and live well.

The *predisposing causes* were mainly those leading to a lower state of vitality, and which consequently lessened the natural resistance of the individual to infection. In this way, as above mentioned, the long-continued and exceptionally hot season of 1896, the unusually heavy rainfall which followed, and which confined the poor constantly in their overcrowded and insanitary dwellings, and the great heat which succeeded the rains, were powerful factors in lowering vitality. Then came scarcity due to dearness of food. During the cold season the unhealthy condition of chawls (native flats) and houses in the city was rendered worse by overcrowding, the inmates being unable to sleep and work in the open, as large numbers of them are accustomed to do during the warmer months. Indeed, the effect of cold alone on the feeble and on those who are insufficiently clothed, as already mentioned, is a powerful factor in lessening resistance to infection.

The largest number of admissions to hospital occurred between the ages of 20 and 30 years. At the Arthur Road Hospital, Bombay, out of 1,275 admissions, 445 or 34·9 per cent. occurred between the ages of 20 and 30 years; 291 or 22·8 per cent. between 10 and 20 years; and 255 or 20 per cent. between 30 and 40 years.

In the Poona Plague Hospital, out of 1,130 admissions, 263 or 23·27 per cent. occurred between the ages of 20 and 30; 137 or 20·97 per cent. between the ages of 10 and 20 years; and 197 or 17·43 per cent. between the ages of 30 and 40.

A constant source of error in these statistics is that the ages of those admitted are seldom or never exactly known, consequently those given are only approximate. Another source of error is that in young children death from plague frequently occurs before the nature of the disease is recognised, so they are not admitted into the plague hospitals. In the case of children, however, the very small number of admissions (*vide* Tables I. and II.) is no doubt partly due to the smaller number exposed to infection, as the exodus which took

place on the outbreak of the epidemic was very largely confined to women and children. The withdrawal of the women gave rise to a marked decrease in the birth-rate of the city, which during the ten months under review fell below the mean of the preceding five years for the same period by 3,685.*

That young adults should give the highest number of admission is not surprising, as they form the largest proportion of the population, and they travel about more, and so are brought more frequently into contact with the disease. The greatest number of admissions into hospital occurred among domestic (cooks, hamals, massalchis) and personal servants, (*vide* Table V.) who formed 20·88 per cent.; mill-hands came next, forming 11·52 per cent.; coolies, 8·8 per cent. The comparatively large number of *dhobies* (native washermen), *darzis* (tailors), *gúolis* (milkmen), and *hajjáms* (barbers) deserves notice, as from their occupation they are likely to spread the disease. The large percentage of admissions among domestic servants is doubtless due to the disease being detected early, and to their masters seeing that they were taken to hospital.

It is impossible to estimate the influence of race and caste on susceptibility to plague, owing to Europeans living under very different sanitary conditions from natives, and to the effect of social position in altering the conditions obtaining among natives themselves; besides, correct statistics cannot be obtained as to the native population present during the epidemic and the numbers attacked by plague.

That more males than females were attacked (*vide* Table IV) is probably entirely owing to the former having been present in larger number.

The *exciting* cause of plague is the plague bacillus of Kitasato, which is believed to gain admission to the body, usually through an abrasion of the skin, or more rarely of a mucous surface. In a number of instances in the present epidemic points of inoculation were found on the extremities of plague patients, from which plague cultures were obtained, and in these cases buboes were found above the point of inoculation. In the majority of instances, however, no local indication could be found marking the point at which the microbe was implanted. Less frequently infection is believed to have occurred in the respiratory organ or in the digestive tract. When the disease appears in the form of primary plague-pneumonia, it may be caused by the inhalation of bacilli disseminated in the air by patients as they cough, or it may be carried by the blood vessels, or lymphatic vessels to the lungs, where it develops.

When a monkey is inoculated by pricking its hand with a needle dipped in plague culture, the slight wound made disappears in a couple of days, and leaves no indication of the point at which inoculation was performed. After four or five days a bubo appears in the axilla or at the bend of the elbow, and the symptoms of plague develop. The lymph from the bubo in these cases contains plague bacilli in great numbers, from which cultures can be made. In the case of man also, as already mentioned, the point at which inoculation occurred was but rarely discovered. Plague bacilli could, however, be obtained in immense numbers, and cultures made from lymph taken from buboes. In septicæmic cases they could be obtained from the blood as well as from lymph from enlarged glands: and in pneumonic cases they were obtainable from the sputa and from enlarged glands when present. Bacilli were probably also present as a rule in the sputa, vomit, urine and fæces of plague patients, but they were hardly ever found in the blood taken from the finger in cases where a bubo was present from the first.

[* The birth-rate in Calcutta fell to 9 per 1,000 in July 1898, owing probably to a similar exodus.—J. K. C.]

The slow spread of plague and the immunity observed among hospital servants, nurses, and medical men who were in constant contact with the disease, handling the sick, and making *post-mortem* examinations, indicates that the germs produced in the bodies of the sick are but little infectious to healthy persons under ordinary circumstances. The conditions under which they become virulent will only be known when the life-history of the microbe outside the body has been traced. Infection occurred most frequently among those living in the same rooms with, and in constant attendance on, the sick, and there can be little doubt but that among the poor and ignorant it was often due to the common custom which exists of friends receiving the sputa of the sick in their hands,* and using their hands and clothing to wipe away discharges from the patient's mouth. It is easy to understand also that want of personal cleanliness among the friends of those affected, and the neglect of precautions as to the disinfection of clothing soiled by the discharges and excreta of the sick, were fruitful sources of infection.

Plague in its epidemic form, as seen in Bombay, is a malignant infectious disease, characterized, in the majority of cases, by enlarged and painful lymphatic glands, high fever and great prostration; and is due to the presence in the system of the plague bacillus.

In the Bombay epidemic the period of *incubation* varied in duration from 36 hours, the shortest,† to ten days, the longest‡ recorded, while in the majority of cases the period of incubation appeared to be from four to six days.

No definite history of *premonitory symptoms* could be obtained, the invasion being, as a rule, sudden and marked by severe rigors or by chills. In infants and young children convulsions frequently ushered in the attack. In a small proportion of cases, however, no marked onset was noticed, the patients stating that the disease began with fever, heat of the skin and pains in the limbs. These cases usually ran a mild course ending in recovery.

The *symptoms* in a typically severe case generally commenced with a well-marked rigor, which was followed by fever, accompanied by vomiting, headache and intolerance of light, pain in the epigastrium and frequently also in the back and limbs. Thirst was unusually much complained of. The *temperature* rapidly rose to 104° F. or more, reaching its maximum, often 105° F. or 106° F., on the evening of the second, or, more rarely, on the first day; occasionally a remission of 1° F., or sometimes more, occurred during the day, but with no regularity as to time. A well-marked fall in temperature of 2° F. to 3° F. or more was frequently noticed on the second or third day, after which the temperature rose again, but seldom to its former height (*vide* Charts III, IV, VII, X, XV, XVII, XVIII, XIX, XX, XXII); a further fall to normal, or sub-normal, occurred between the fifth and seventh days (*vide* Charts I, II, III, VII, XXII). In uncomplicated cases a fall to normal

* It seems not improbable that plague cultures grow in the *ghee* always present under the nails of natives who eat curry with their hands, and that they often infect themselves from the cultures when scratching skin eruptions, etc.

† The case of Chinwal Khan reported by Surgeon-Major MacCartie, Health Officer of the Port of Bombay, on the 11th January 1897.

Chinwal Khan was a fireman on the S. S. *Hydaspes*, which arrived from Shanghai (an uninfected port) on Thursday, 7th January, and entered dock the same evening. He did not complain of illness during the voyage to Bombay, and was on regular duty up to the evening of the 7th. Probably on that evening, and certainly on Friday morning, the 8th, he visited the city. On Saturday morning, the 9th, he complained of fever and pain in the groin, and on examination was found to be suffering from plague. The incubation period in this case was at most 1½ days and may have been only one day.

Nurse Joyce went to attend on Surgeon-Major Manser on the 4th January at his house. She was in good health and had not been near plague cases up to that day. She nursed him from 4th to the morning of the 6th. She was attacked by plague on the evening of the 7th, and died on the 9th January 1897.

‡ This period cannot be accepted as finally settled, as the person attacked, a native of Bombay, may have carried the infection with him and infected himself in Poona, where he was attacked ten days after arriving from Bombay and before plague had broken out in Poona.

sometimes occurred on the second or third day (*vide* Charts XX, XXVI), and was often attributed to a particular line of treatment when it was really the usual course of the temperature unaffected by the treatment. The occurrence of complications, *e. g.*, the appearance of fresh buboes, secondary pneumonia, etc., gave rise to great irregularity in the course of the temperature (*vide* Charts II, XIV, XX, XXIII, XXVIII).

Nausea and vomiting were met with *at the onset* in almost every case, and frequently continued for the first day or two. Splitting frontal or general headache was present from the first and continued while the temperature remained high, subsiding with the fall which occurred on the second or third day. Occasionally epistaxis occurred about this time. The countenance was pale; the eyes red and injected with bands of deeper colour at the outer and inner canthi owing to the eyelids remaining constantly unclosed. Sleeplessness was a distressing symptom, and there was often delirium at night. The pulse frequent, 100 or more, and full at the beginning, soon became soft, compressible, and dicrotic, and eventually running, so that it was difficult or impossible to count. The tongue was, as a rule, very characteristic. At first it was tooth-indented, somewhat swollen, and evenly covered with a thin white fur, except at the tip and edges, where it was clean. Later, it became dry, thickly covered with a yellowish white or brownish-white fur, the tip and edges remaining red and irritable. The bowels were almost always constipated at first, but sometimes diarrhœa was present.

Buboes were met with in over three-fourths of the cases, and in about half the number of cases in which buboes were found, the glands of the vertical set in the groin were involved. They were as a rule noticed at the onset of the disease, giving rise to lancinating pain, but in a number of cases were not found until the second or third day. Generally one gland was markedly affected, and two or more adjacent ones less so. The affected glands varied in size from that of a filbert to a walnut, and they were very tender from the first, although often but little swollen. When in the groin the patient kept the thigh well flexed on the abdomen in order to relieve tension. In about two-thirds of the remaining cases the axillary glands were found to be affected, the patient usually lying on his back with the arm held away from the side and kept perfectly still. In the remaining third the glands below the angle of the jaw or of the superficial cervical set were enlarged.

As a rule a bubo appeared only in one region, but sometimes they were found in more than one region, or on both sides of the body. As the disease progressed, the glands of the same chain, situated above those first affected, often became enlarged; so that in cases of a femoral bubo the glands lying along the course of the external iliac and common iliac vessel were also found to be enlarged and tender on pressure. A rise in temperature occurred with each fresh gland or group of glands involved.

In cases which proved fatal early, the buboes continued hard and very tender to the last; while in more prolonged cases effusion, frequently large in amount, occurred around them, giving rise to a doughy or brawny swelling, and often causing œdema of the limb below from pressure on the vessels and nerves. [In some of these cases with axillary buboes, this œdema would occupy the whole of the side of the thorax, occasionally reaching even as far as the haunch-bone. The prognosis in these cases is unusually grave.—W. B. B.]

With the appearance of effusion the buboes usually became less painful. In a few cases where the patient lived long enough, the swelling subsided by resolution, but in the majority of instances suppuration occurred after the seventh or eighth day, the skin over the infiltrated area becoming inflamed. On opening the bubo thin yellowish or sanious pus was evacuated; the skin frequently sloughed eventually, however, leaving an indolent

unhealthy ulcer, with ragged, overhanging edges and a greyish sloughing base, on which one or more necrosed lymphatic glands might be seen. Such ulcers usually took weeks to heal and gave rise to large thickened cicatrices. In cases where suppuration did not take place, the glands remained hard and indurated long after convalescence was established.

The nervous system was markedly affected in almost every case from the beginning of the fever. The patient complained of extreme feebleness and prostration; in many cases he could only walk with the greatest difficulty, and was sometimes unable even to leave his bed. There was some loss of sensibility to touch, and often the general cutaneous sensibility to pain also seemed impaired, but in a few cases there was marked hyperæsthesia.

Intelligence was generally unaffected at first, but sometimes the patient appeared to be dazed and stupid and totally indifferent to his surroundings. Memory was defective, or he was unequal to making an effort of memory when asked, for example, to give the date of attack, or to state what his symptoms had been. In a number of cases, owing to inco-ordination of the lingual muscles, there was thickness of speech like that caused by alcoholic poisoning, and this symptom was so characteristic that the attendants in hospital came to look upon it as a certain sign of plague in cases where enlarged glands had not already appeared. Later in the disease dumbness not infrequently occurred from paralysis of the laryngeal muscles. In addition to loss of muscular power in the upper and lower limbs there was tremor and twitching of the muscles of the hands, and in many cases marked loss of co-ordination also, causing clumsiness of movement in the hands, and giving rise to a staggering gait on attempting to walk. As a rule, there was loss of expression, owing to relaxation of the facial muscles, giving the patient an apathetic or a stupid look, and masking the approach of death. Occasionally at the beginning of the illness the expression was anxious. In a number of cases cerebral symptoms were present from the commencement of the disease and continued day and night throughout the attack, taking sometimes the form of delirium and at others that of coma. The delirium was of the busy type, like that of delirium tremens, and was often accompanied by illusions terrifying in character, from which the patient tried to escape; among children convulsions frequently took the place of delirium. In cases marked by stupor the mental faculties appeared to be paralysed, the patient lying in a comatose condition, from which he could only be roused with difficulty, if at all. Such cases generally died within the first two days, but sometimes even within 24 hours.

The respiratory symptoms were hurried breathing and a sense of oppression and tightness across the chest. In most cases congestion of the bases of the lungs occurred early, and was rapidly followed in many instances, particularly during the cold months, by bronchitis, by oedema of the lungs, or by secondary pneumonia. In these cases of secondary pneumonia the expectoration was bronchitic in character, and after a short time became profuse and watery, often showing a considerable colouring of blood. These blood-stained serous sputa, owing to the patient's clothing becoming reddened by them, sometimes gave rise to the impression that hæmoptysis had occurred. Primary plague-pneumonia was also met with, but this form of plague (which was first recognized and described by Surgeon-Captain Childe) during the present epidemic is so important as to require a detailed description.

In connection with the digestive system, the occurrence of vomiting at the onset of the disease, in some instances accompanied by diarrhœa, has been referred to above. In some cases nausea, vomiting and diarrhœa, appeared at the onset and persisted throughout the whole course of the attack. The vomited matter was at first bilious in character; afterwards it contained only water and such liquid nourishment as had been taken. Diarrhœa, when it occurred, was also

bilious in character, the motions numbering five or six in twenty-four hours, the stools being always very offensive and sometimes tinged with blood. In a certain proportion of cases there was pain and tenderness in the epigastric region, pain in the back, and abdominal distension, accompanied by enlargement of the liver and spleen. Surgeon-Captain Hojel has recorded a number of cases of this sort in which low nervous symptoms occurred like those met with in enteric fever, and in some of these cases petechiæ were seen on the abdomen and lower part of the thorax somewhat resembling the rash of enteric. After death the lesions found were those of plague; Peyer's patches were found to be slightly raised, œdematous and congested, the solitary follicles were as large as hempseed, but enlargement of the mesenteric glands was absent.

In the circulatory system there was throbbing of the carotids, and the apex beat of the heart could generally be seen at the beginning of the attack. The impulse at the apex was found to be more diffuse than normal, and sometimes a thrill could be felt in the præcordial region. The sounds soon became feeble, the first sound being very much shortened, and the second sound so weak that it frequently could not be heard at the apex. In one case only, out of a very large number examined, was a murmur present, although in many cases the heart appeared to be dilated. On examining the blood drawn from the finger it was found to coagulate slowly, and the red corpuscles did not tend to run into rouleaux quickly. In cases where the disease had lasted for a few days the number of white corpuscles present was greatly in excess of the normal. In most cases after the first day, and in all cases after two or three days, a marked fall in blood pressure occurred; this fall in blood pressure and the great frequency of the heart's action were the most marked circulatory changes observed.

In the urinary system pain was sometimes present in the region of the kidneys. The urine secreted was diminished in quantity, of high specific gravity, and intensely acid in reaction. In colour it was generally brownish yellow, but sometimes it was smoky or red from the presence of blood. Albumen was present in about three-fourths of the cases, urea and uric acid were deficient, and chlorides markedly deficient; casts were generally present. A quantitative urine analysis was made by Surgeon-Captain Hojel in fifty plague cases treated at St. George's Hospital. With the exception of one, all the analyses were made between the third and sixth day; all were examined as soon after admission as possible, and the majority for several days in succession. Micturition was frequent in many cases, but no symptoms of scalding were as a rule complained of. In cases which terminated fatally, the urine was often retained towards the end.

Where pregnancy was present, the patient, as a rule, aborted on the first or second day after the onset of the disease, and died, but this was not invariably the case. Out of three pregnant cases treated at St. George's Hospital, only two aborted, and both recovered: the third (*vide* Chart XXII), two months pregnant, went on to full term. When premature labour occurred, both mother and child usually died. In one case, however, a native woman was attacked by plague five days before full term; she was confined the same day and died, but the child was born alive; it exhibited no symptoms of plague, and is still living.

The skin was hot and burning to the touch from the first, and continued dry and harsh until the temperature began to decline on the third or fourth day, after which it became moist. On the temperature falling to normal or subnormal, sweating almost invariably occurred and continued for a few days, being usually worse at night.

Occasionally before death, petechiæ were observed over buboes or on the abdomen; but no characteristic skin eruptions were seen. In some instances small patches of skin (unconnected with lymphatic glands), two or three inches or more in diameter, became inflamed, and eventually sloughed, leaving indolent ulcers with steep overhanging edges. These

patches were noticed in some cases at the sides of the abdomen, or thorax and over the loins, where they were in no way due to pressure or irritation; but more frequently they occurred on the extremities, being situated on the dorsum of the foot or hand, on the leg, thigh or forearm. Sometimes extensive sloughing occurred, laying bare the muscles over considerable areas, and giving rise to severe hæmorrhage. Rarely boils were seen, which became black, owing apparently to capillary hæmorrhage; but no true carbuncles were observed.

Amongst natives the progress of the disease was towards death in about 70 per cent. of the cases admitted into the Arthur Road and Parel Hospitals; among Europeans and Eurasians treated in St. George's Hospital the mortality was less, *viz.*, 32·35 per cent. and 42·62 per cent. respectively. As death approached, respiration became more and more shallow and feeble, the eyes became sunken, and the patient passed from a state of muttering delirium into coma, and died, as a rule, quite quietly from heart failure.

Sometimes the temperature ran up to 107° F. or more before death, and continued to rise after death; but more frequently death appeared to occur from collapse, the temperature falling and the pulse increasing in frequency to such an extent that it could not be counted. In cases that recovered the temperature generally fell by lysis on the fifth, sixth and seventh days. But not infrequently a fall by crisis occurred on one of these days (*vide* Charts II, VIII, XXII), and the patient remained in a more or less collapsed condition with subnormal temperature, profuse perspiration and an exceedingly feeble pulse for days. In this condition the slightest effort sometimes gave rise to fatal syncope. In the Parel Hospital 22 convalescents, out of 304 cases treated there by Captain Thomson, dropped dead through attempting to get out of bed or to sit up.

When the patient was recovering, it was occasionally found that he was suffering from dumbness or from partial laryngeal paralysis; or that hemiplegia, paraplegia involving the legs or the legs and arms, monoplegia of a limb or a portion of a limb was present. In some cases facial paralysis was observed, or paralysis of one or more ocular muscles. More rarely the inco-ordination of the tongue, hands, arms or legs, noticed at the beginning of the attack, remained present during convalescence, and the speech continued slow, thick, and indistinct.

(A reference to the case of Kallian Vishram has been omitted here.—J. K. C.)

Occasionally an attack of plague ran a very mild course, the patient (frequently a boy of ten or twelve years) not being confined to bed by it. In these cases enlargement and tenderness of a lymphatic gland was noticed, followed by fever (*vide* Chart XXVI), headache, a characteristic tongue and sometimes nausea and vomiting; the temperature rarely exceeded 103° F. or 104° F., and generally fell to normal or subnormal on second or third day. Prostration and cerebral symptoms were not well marked, and the bubo subsided as a rule without suppurating. The duration of the attack seldom exceeded three or four days, and convalescence was established in a week or ten days.

There remain to be described two forms of the disease in which the general features of plague in its most acute form were present, but in which there was no particular enlargement of lymphatic glands (buboes) during life, and in which, after death, only very slight general enlargement and congestion of the glands were found.

In one of these forms of plague the microbe grows in the blood, hence it has been called *septicæmic plague*: in the other it grows in the lungs giving rise to *primary plague-pneumonia*.

In *septicæmic plague* the invasion was usually marked by a prolonged and severe rigor, or repeated rigors; and vomiting, headache and high fever were constantly present. The most distinctive features of this form of the disease were the great nervous prostration and muscular weakness present from the beginning, and the rapidity with which cerebral

symptoms supervened. Delirium often set in during the first day, and was quickly followed by picking at the bed clothes, stupor and coma, in which the patient died generally on the second or third day, but sometimes within twenty-four hours of the onset. In some cases death did not occur for several days. The pulse early became soft and very frequent, 120 to 140 or more; the temperature (*vide* Chart XXV) rapidly rose to 104° F., 105° F., 106° F., ran an irregular course and often reached 107° F. or more before death; respiration was hurried and panting; gastro-intestinal catarrh and tympanitis were frequently present; the urine was often retained. Epistaxis and sub-conjunctival hæmorrhage sometimes occurred; blood was occasionally seen in the stools and urine; and, if the patient lived long enough, secondary pneumonia sometimes set in. These cases were very fatal.

In a considerable number of cases *primary plague-pneumonia* was observed, the development of the disease being due to the growth of plague bacilli in the lung tissue. Lobular pneumonia was the form usually met with in these cases. Its onset was marked by rigors, or, in some instances, by chills, followed by a sense of constriction across the chest, difficult and hurried breathing, cough and expectoration. As the disease progressed, respiration became very frequent (forty to sixty in the minute) and difficult, and duskiness of the face appeared. Pain was present, but never appeared to be severe or stitch-like in character, and was rarely much complained of. The expectoration, bronchitic at the beginning, very soon became watery and profuse; it often contained little whitish specks floating in it, and on examination was found to contain plague bacilli in great numbers. Frequently this serous expectoration was tinged of a pink or reddish colour from the presence of blood; but rusty sputa, as in ordinary croupous pneumonia, were rarely seen. There was great prostration from the first; the pulse soon became feeble and very frequent, so that the alteration in the pulse-respiration ratio ordinarily met with in pneumonia was not observed; the temperature was high and ran an irregular course (*vide* Charts XI, XII, XVII, XIX, XXIX, XXX, XXXI), the tongue was coated white, except at the tip and edges, and the bowels were confined. The physical signs present were those of broncho-pneumonia, patches of consolidation being found in one or both lungs, the right generally being the one most affected. Very soon marked œdema occurred, the lungs becoming loaded with fluid. Buboes were not met with in these cases, but slight enlargement of the lymphatic glands was sometimes found before death. Death generally ensued in three or four days, and was preceded by incessant cough and by blueness of the skin due to deficient aëration of blood, caused mainly by the amount of fluid in the air vesicles.

The complications met with in plague were—in the nervous system delusions, in one case ending in insanity; motor paralysis, local or general; impaired sense of touch; sometimes diminished sensibility to pain, sometimes hyperæsthesia; deafness; ulceration of the cornea, conjunctivitis, and sub-conjunctival hæmorrhage. In the circulatory system, softening of the muscular tissue of the heart with enfeebled cardiac action and dilation of the heart. In the respiratory system, bronchitis; hypostatic congestion and œdema of the lungs; secondary pneumonia; pleurisy; and rarely pulmonary hæmorrhage. In the digestive system, gastro-enteric catarrh; diarrhœa; and in a few cases hæmorrhage from the bowels. In the urinary system, albuminuria; renal congestion, and renal hæmorrhage, in one case causing death. In the reproductive system, menorrhagia at the menstrual period; and abortion in many cases of pregnancy. In the cutaneous system, sloughing of the skin and boils.

The sequelæ most frequently met with were deafness in one or both ears; impairment of vision due to degeneration of the choroid and retina; dumbness due to the loss of memory of words, or to laryngeal paralysis; paralysis of the muscles of the eyes or face; paresis or

paralysis of the muscles of the extremities either hemiplegic or paraplegic ; inco-ordination of the muscles of the face, tongue and extremities ; impairment of cutaneous sensibility to pain.

The duration of the disease in 902 fatal cases admitted into hospital was 19 hours in one case, one day in 5, two in 43, three in 99, four in 143, five in 129, six in 85, seven in 76, eight in 56, nine in 42, and ten in 24 cases. It must be remembered that probably very few of the cases dying during the first twenty-four hours were brought to hospital, and that many of the cases dying on the second and third day were also not detected and sent to hospital. The average duration of the disease from attack to death in seventeen fatal cases among native prisoners in the House of Correction, Byculla, was five and a half days.

Second attacks from plague occurred in two cases which have been recorded. In the first case, the patient who had suffered from plague at Hongkong in June 1894 was attacked in Bombay on the 6th December 1896, had rigors, vomiting, high fever (105° F.), severe headache, and a bubo in the right groin. The fever and other symptoms subsided within a week and she recovered. The second case was that of a cooly admitted into the Arthur Road Hospital in November 1896 for plague. He was discharged cured in December and continued to work until February 1897, when he was re-admitted for plague and died.

The diagnosis of plague in its most typical form is easy. The sudden onset, rapid rise in temperature, vomiting, headache, sleeplessness, the stupid expression, injection of the eyes, thick speech and great prostration point to plague ; and later, the condition of the tongue, the frequent and very feeble pulse, the enlarged and painful lymphatic glands, the course of the temperature (showing a marked fall on the second or third day followed by a further fall to normal or subnormal between the fifth and seventh days) and the rapidly fatal course of the disease in the majority of cases, render the diagnosis unmistakable.

When however the disease takes the form of *primary plague-pneumonia*, it becomes exceedingly difficult to diagnose, whilst at the same time, owing to the danger of infection from the sputa which contain plague bacilli in great numbers, it is most important to recognise it early. In primary plague-pneumonia the absence of acute or subacute bronchitis before the attack ; the rapidity with which high fever, severe headache and marked prostration occur after the onset ; the character of the expectoration, less viscid from the first and early becoming profuse and watery, and generally tinged with blood or reddish from admixture of blood ; the rapidity with which signs of œdema of the lungs appear ; the quality of the pulse, which is never full and bounding, and soon becomes very soft and frequent, serve to distinguish it from ordinary broncho-pneumonia or lobar-pneumonia in the majority of cases ; and the presence in all cases of immense numbers of plague bacilli in the sputa, from which cultures can be obtained, renders the diagnosis certain.

Severe cases of *malarial fever* may be distinguished from plague by the nature of the onset, the cold stage being more prolonged, the features pale and shrunken, and the nails blue. In the hot stage the face becomes flushed and the pulse full and bounding, but is not so rapid as in plague. In malarial cases, too, the temperature generally shows marked periodicity ; there is no prostration, patients possessing as a rule their muscular strength and mental energy ; and buboes are very rarely met with.

Relapsing fever, like plague, occurs in times of scarcity. In both the onset is sudden, and rapidly followed by high fever, accompanied by severe headache, frequent pulse, and a hot and burning skin ; the tongue is furred white, the temperature reaches its maximum on the first or second day, and a remission accompanied by sweating often occurs on the second

day or third day, the temperature falling to normal between the fifth and seventh days (*vide* Chart XXI). But in relapsing fever there is giddiness ; prostration is slight ; jaundice not infrequently occurs on the third or fourth day ; the face is flushed, and the expression is not stupid nor confused ; buboes are not met with ; and spirilla are found in the blood during the height of the fever.

Plague in its onset and early symptoms somewhat resembles *typhus fever*. But the duskiess and flushing of the face present at the beginning of typhus fever, and the occurrence of an eruption on the body and limbs between the fifth and seventh days, as well as the different course of the temperature (*vide* Chart IX), and the absence of buboes would serve to distinguish between them.

Owing to the feebleness, thick utterance and staggering gait, frequently seen in plague cases, the disease is sometimes mistaken for *alcoholic poisoning*. The following is a typical case. Govind Jeeva was taken by his friends for treatment to a qualified medical practitioner. They stated that he had had a fall, and the following note of his case was made : "Pupils slightly dilated, breath smells very faintly of alcohol, has a slight contused wound over but not exposing malar bone," and an emetic was prescribed. Fortunately this was not given. Next day a note was made as follows : "Bowels not opened for two days ; is not quite recovered from the effects of drink," and on the following day : "Speech indistinct, temperature 102° F., bowels not opened." On the fourth day he died. In this case enquiry showed that the patient had been two days ill with fever, and was given a little alcohol after having fallen down in a faint. He was seen by another medical man shortly after the emetic was prescribed, and found to have a very frequent and feeble pulse, fever, and a typically coated tongue. The diagnosis of plague was made and afterwards verified by *post-mortem* examination. Had the case been one of alcoholic poisoning, there would have been a full and bounding pulse, a normal or subnormal temperature, and considerable mental excitement ; or in a later stage drowsiness, or coma with stertorous breathing, a slow and compressible pulse, and a subnormal temperature.

In plague cases where *abdominal symptoms* are marked and a typhoid condition has supervened, the diagnostic features given by Captain Hojel are :—The onset is sudden, usually ushered in by a well-marked rigor ; the temperature shows a high initial rise in most cases, followed by a marked remission to normal (or a little above or below it) on the second, third or fourth day (*vide* Chart XXIV) ; the pulse larger and full at first, becomes peculiarly soft and is characterized by a great want of sharpness in stroke ; it is very compressible at an early stage and dicrotic, but the dicrotism is not very easily recognized by the finger ; the aspect is dull, heavy and apathetic, and the patient has a peculiar stricken look ; the eyes are dull and muddy looking, the conjunctivæ are suffused, but the pupils in most cases are normal ; there is generally flushing of the face ; diarrhœa, when present, is simple, but very offensive ; delirium and other cerebral disturbance occur early, and there is great prostration from the first ; abdominal distension occurs early, on the third, fourth or fifth day ; the eruption is not readily effaced and is of a "deep red colour (petechial)" ; there is severe lumbar pain in many cases.

During the present epidemic no cases of *glandular fever* among children or young adults were met with ; nor did an outbreak, characterized by the appearance of buboes, and accompanied by a little or no constitutional disturbance, precede or accompany the outbreak of plague in Bombay. Until bacteriological diagnosis has settled that the microbe in these cases is the plague bacillus, it is premature to speak of them as cases of benign plague. In Calcutta a number of cases of this sort were seen, but no outbreak of plague occurred for over 17 months afterwards.

The bacteriological diagnosis of plague is purposely omitted from the main report, to be given in full detail in Mr. Haffkine's report. It cannot be carried out in practice by medical men who have no special bacteriological training nor access to a laboratory, and as they are the first persons who come in contact with the disease, it is of especial importance that they should be able to recognise plague cases by their ordinary clinical features.

The *prognosis* of plague is always exceedingly grave, as it is the most fatal of all known epidemic diseases. Dr. Viegas, who practises on the Port Trust Estate, and was the first to notice the presence of plague in Bombay about the third week in September 1896, states that the mortality during the first four weeks after the outbreak was discovered lay between 95 and 99 %, and between the end of October and the end of November between 85 and 90 %.

The mortality in 1,579 cases treated in the Arthur Road and Parel Hospitals was 69·54 %. In the Poona Plague Hospital, out of 1,130 patients admitted, 757 died, giving a mortality of 67 %.

In the House of Correction, Byculla, however, where the entire number of those attacked were admitted into hospital at once, only 17 persons died out of 33 attacked, or 51·52 %. These prisoners were all adults between 20 and 50 years of age, in good bodily health, and carefully attended to from the time they fell ill.

In Damann, out of 110 persons living in the same families, 54 were attacked by plague, of whom 37 or 68·52 died.

Under ordinary conditions therefore the mortality among those attacked during the present outbreak was probably between 65 and 70 %.

Looking at the mortality, according to race and caste, among the patients admitted into Arthur Road and Parel Hospitals (Table II), the highest mortality, 71·25 %, occurred amongst Hindoos; then follow Jews with 66·67 %, Native Christians with 65·45 %, Brahmins with 65·21 %, Parsees with 64·29 %, and Muhammadans with 64·24—the number of Jews (9), Brahmins (23), and Parsees (14), however, were too small to give reliable results.

Among Europeans and Eurasians a much lower death-rate, 38·95, occurred, owing most probably to their possessing more stamina, and being treated earlier and more carefully nursed during the attack. Out of 34 Europeans admitted into St. George's Hospital, 23 recovered and 11 died, the percentage of deaths to attacks being 32·35,—while out of 61 Eurasians under treatment, 58 recovered and 3 died, or 4·92 % of deaths to attacks. It was noticed that while among natives the lowest percentage of deaths to attacks occurred between the ages of 1 and 20 years, in Europeans and Eurasians it lay between the ages of 20 and 40 years; also that between 20 and 40 years the percentage of deaths to attacks was twice as high among natives (69·75) as among Europeans and Eurasians (34·21).

It is impossible to give any definite prognosis with regard to individual plague cases, as sometimes those that appear to be quite hopeless recover, while others apparently much less severe die. The conditions regarded as most unfavourable are the occurrence of the disease in its septicæmic form, or as primary plague-pneumonia. Among cases in which buboes are found, those where the buboes are situated in the cervical region appear to be more unfavourable than those with buboes in the axilla or groin; and cases with multiple buboes are more unfavourable than those with single buboes. The symptoms which are generally looked upon as unfavourable are the persistence of severe and continuous vomiting, and the early appearance of diarrhoea, the early onset and continuance of violent

delirium, or the setting in of coma. The appearance of petechiæ is generally believed to precede death, and hæmorrhages from the kidneys and bowels are considered very unfavourable.

Attacks occurring late in the epidemic, although often no less severe in their onset (Chart XXVI), run a milder course than those occurring at the beginning of the outbreak.

Treatment.—No specific remedy has up to the present been discovered for the treatment of plague cases.

During the present epidemic two lines of treatment have been tried, the one, *hygienic and symptomatic*, with the object of tiding the patient over a certain period, when, as in the case of the other specific fevers, experience has shown that there is a natural tendency to recovery; the other, *the antitoxic treatment*, with the object of neutralizing by means of antitoxic serum the virus produced by the microbe, and of preventing the growth of the bacillus itself.

The hygienic and symptomatic treatment consists in economising, as far as possible, the nervous and muscular energy of the patient by placing him under the most favourable conditions and treating symptoms. With this object a plague patient is put to bed at the onset of the disease, kept in the recumbent posture (on account of the tendency which there is to fatal syncope) until convalescence is established, and supplied with suitable nourishment at short intervals.

The symptoms which require special attention are those connected with the nervous system and with the circulation. In the nervous system they are mainly due to congestion of the nervous centres at the commencement of the attack, followed by œdema towards its close, the former giving rise to fever, headache, vomiting, insomnia, and delirium, the latter to stupor and coma. These symptoms are treated on general lines, *i. e.*, the avoidance of light, the application of ice or cold water to the head and surface of the body if the temperature continues high, and the use of hypnotics and sedatives for sleeplessness and delirium.

In connection with the circulation the symptoms to be combated are vasomotor paralysis and heart failure, the latter probably due partly to the direct action of the toxic poison on the cardiac ganglia and partly to softening and degeneration of the muscular wall of the heart. For these symptoms the use of alcohol in some form is generally required after the first day; in most cases also the administration of drugs which act as cardiac tonics and vascular stimulants, such as ammonia, digitalis, strychnine, quinine is found necessary. All drugs which depress the heart and circulation should, as far as possible, be avoided.

The treatment of pneumonia, primary or secondary, calls for the free administration of stimulants and of stimulating expectorants for the relief of cough and dyspnoea, due to the accumulation of fluid in the bronchial tubes.

Gastro-intestinal symptoms, buboes, and such other complications as arise are managed on general principles.

In *treatment by antitoxine* the correct principle of removing the cause of the disease is aimed at, but up to the present time, so far as information is obtainable of M. Yersin's results, and those of other doctors, French and Russian, who have tried it, it has failed to influence favourably the mortality among those attacked.

Surgeon-Captain Thomson, the Medical Officer in charge of Parel Plague Hospital, supplies a tabular statement (*vide* Table VIII), showing the details of 27 cases under his

care treated by M. Yersin's antitoxic serum. From these 27 cases he excluded 4 (2 of which died and 2 recovered), viz., one suffering from meningitis and an osseous tumour pressing on the medulla (case 4), one treated prophylactically (case 11) and two which were not plague cases (cases 24 and 27). Of the remaining 23 plague cases, 14 or 60·83 per cent. died.

[A reference to an antitoxic serum prepared by Mr. Haffkine, but distinct from his well-known prophylactic, occurs in Dr. Lyons' report at this point, but as the results are not given it is omitted.—J. K. C.]

The *prophylactic measures* which demand attention on the occurrence of a case of plague in a family are the removal, when practicable, of the unaffected members from the house, to allow of its being thoroughly cleaned, and of the patient to a hospital where he can receive proper care and attention, unless suitable provision can be made for his treatment at home. All those who have been living with him should undergo inoculation against plague, as this is found to diminish the risk of infection by 70 to 80 per cent., and to increase the prospect of recovery in those attacked after inoculation by 60 to 70 per cent. (*vide* report on inoculation). The patient's sputa and excreta and all discharges from buboes and sores should be received in vessels containing suitable disinfectants, and on the termination of the illness everything which was used by him, or had been rendered liable to contamination, should be thoroughly cleansed and disinfected, or, if practicable, burnt (*vide* Mr. Hankin's Report).

Nurses and attendants who are in close and constant attendance on plague patients, should undergo inoculation. All wounds and abrasions on the hands, etc., should be protected from the risk of infection, and the hands should be thoroughly washed and disinfected after dressing sores or otherwise becoming soiled. Their natural immunity should be increased as much as possible by regular meals, sufficient exercise and rest, to ensure their keeping in good health.

[The cases of Kondabai and Noronha (illustrating the course of plague in the inoculated), and that of Kallian Vishram (a case of marked general inco-ordination and paresis after plague), as well as Tables VII and IX and the General Appendix containing the Committee's recommendations have been omitted here.—J. K. C.]

TABLE I.

A Table showing the admission among Europeans and Eurasians into St. George's Hospital Bombay, at different periods of life, and giving the results.

		1 Year and under	Years 2 to 5.	Years 6 to 10.	Years 11 to 20.	Years 21 to 30.	Years 31 to 40.	Years 41 to 50.	Years 51 to 70.	Total.	Percent- age of deaths to attacks.
Europeans ...	R	1	0	6	4	6	6	0	0	23	} 32·35
	D	0	1	3	0	3	2	1	1	11	
Eurasians ...	R	0	0	4	13	10	3	3	2	35	} 42·62
	D	0	0	2	12	6	2	2	2	26	
Total ..	R	1	0	10	17	16	9	3	2	58	
	D	0	1	5	12	9	4	3	3	37	
Percentage of deaths to admis- sions ...		} 0	100	33·3	41·38	36	30·76	50	60	38·95	

R=Recovered. D=Died.

TABLE II.

A Table showing the admissions among Native Christians, Jews, Parsis, Mohamedans, Brahmins and other Hindus into the Arthur Road and Parel Hospitals, and giving the results : for the Arthur Road Hospital the admissions at the different ages are shown.

		1 Year and under.	Years 2 to 5.	Years 6 to 10	Years 11 to 20.	Years 21 to 30.	Years 31 to 40.	Years 41 to 50.	Years 51 to 70	Total.	Treated in Parel Hospi- tal.	Total.	Percent- age of deaths to attacks.
Native Christians ...	R	0	1	4	19	14	7	9	0	54	22	76	65.45
	D	0	2	3	23	30	16	24	1	99	45	144	
Jews ...	R	0	0	1	0	0	0	1	0	2	1	3	66.67
	D	0	0	1	2	0	0	0	0	3	3	6	
Parsis ...	R	0	0	0	2	0	1	0	0	3	2	5	64.29
	D	0	0	0	1	1	1	2	0	5	4	9	
Mahomedans ...	R	0	0	0	16	19	9	7	0	51	8	59	64.24
	D	0	0	4	21	24	25	24	0	98	8	106	
Brahmins ...	R	0	0	0	2	2	1	0	0	5	3	8	65.21
	D	0	0	0	0	3	3	0	0	6	9	15	
Other Hindus ...	R	5	2	19	66	106	42	17	1	258	72	330	71.25
	D	0	6	32	139	246	150	112	6	691	127	818	
Total...	R	5	3	24	105	141	60	34	1	373	108	481	69.54
	D	0	8	40	186	304	195	162	7	902	196	1,098	
Percentage of deaths to admissions ...		0	72.73	62.5	63.92	68.31	76.47	82.65	87.5	70.74	64.17	69.54	

TABLE III.

A table showing the comparative case mortality per cent. among (a) Europeans and Eurasians, and (b) Natives, in youth, adult life and old age.

	Years 1 to 21.	Years 21 to 40.	Years 41 to 70.
Europeans and Eurasians	28 or 39.137 per cent.	25 or 34.21	5 or 54.55
	18	13	6
Natives ...	177 or 62.34	255 or 69.75	49 or 81.51
	ea3	588	216

TABLE IV.

*A Statement showing the number of deaths from Plague in Bombay according to age and sex from August to December 1896.**

Months.		1 Year and under.	Years 2 to 10.	Years 11 to 20.	Years 21 to 30.	Years 31 to 40.	Years 41 to 50.	Years 51 to 60.	Years 61 and over.	Total.
August ...	Males	...	...	...	...	...	...	...	...	...
	Females	...	...	...	...	...	...	...	...	...
September	Males	...	4	15	18	14	5	4	3	63
	Females	...	1	3	6	2	3	1	...	16
October ...	Males	1	11	58	81	36	23	10	4	224
	Females	...	15	23	23	10	12	5	1	89
November	Males	1	15	51	64	32	18	7	5	193
	Females	...	23	25	22	8	8	2	2	80
December...	Males	1	56	208	291	183	91	42	18	890
	Females	2	49	109	95	50	45	14	17	381
Total...	Males	...	...	...	...	...	...	...	...	...
	Females	...	...	...	...	...	...	...	...	...
Percentage		22	8.47	25.41	30.99	17.30	10.59	4.39	2.58	...
		2	78	160	146	70	68	22	20	566

* Details up to 31st May have not yet been received from the Health Department.

TABLE V.

Admissions into the Arthur Road Hospital according to Occupation.

Occupation.	Numbers of each class.	Total.
Domestic Servants *	266	266
Mill-hands	147	147
Coolies	110	110
Syces	49	49
Beggars	41	41
Sepoys (including Native Soldiers and Police)	21	21
Dhobies, Labourers (each)	19	38
Dirzies	18	18
Gowlies, Metal-workers, Peons (each)	15	45
Cart-drivers	13	13
Malies	12	12
School children, Carpenters (each)	11	22
Barbers	10	10
Shopkeepers	9	9
Clerks and Butchers (each)	8	16
Printers	7	7
Masons	6	6
Shoemakers, Painters, Sweepers (each)	5	15
Ward-boys and Lascars (each)	4	8
Priests, Sailors, Firemen, Wool-cleaners, Bakers, Carpenters, Com- pounders, Fishermen (each)	3	24
Unclassified ... ..	...	398
		1,275

* Including personal servants, cooks, hamals and masalchies.

TABLE VI.

*A Statement showing the number of deaths from Plague in Bombay City according to Occupation from September to December 1896.**

No.	Occupation.†	Number of deaths in				Total.
		Sept.	Oct.	Nov.	Dec.	
1	Municipal and Local Bodies (including Police) ..	...	...	2	19	21
2	Devotees, Blikshuks, ‡ Fakirs, etc. ...	...	2	4	11	17
3	Indoor servants	2	3	5	26	36
4	Dhobies (Washermen) ... ..	...	...	2	17	19
5	Servants not otherwise described	5	8	6	27	46
6	General Merchants ... ..	...	6	1	4	11
7	Bankers ... ..	...	1	2	9	12
8	Commercial Agents, Brokers, etc.	6	9	2	7	24
9	Commercial Clerks, etc.	1	11	8	36	56
10	Drivers of public vehicles ... ..	...	1	...	5	6
11	Cart-owners and drivers .. ..	...	3	4	15	22
12	Seamen (not Government) ... ..	...	...	...	5	5
13	Messengers, Porters, etc. (not Government) ... ..	...	3	1	6	10
14	Jockey Grooms .. ..	...	4	4	10	18
15	Fishermen, etc. ... ..	...	2	...	5	7
16	Printers by steam, compositors ... ..	...	...	...	8	8
17	Figure casters (Otarva) ... ..	...	...	...	5	5
18	Engine-makers (Fitters, etc.) ... ..	...	2	...	9	11
19	Carpenters, Joiners, Sawyers .. ..	...	3	4	18	25
20	Masons and Bricklayers ... ..	...	1	1	12	14
21	Cotton Dyers ... ..	...	...	...	5	5
22	Spinners, Weavers and Factory workers ... ..	...	1	...	16	17
23	Cotton goods sellers, drapers	1	1	...	3	5
24	Tailors	1	6	4	11	22

* The details up to 31st May 1897 have not yet been received from the Health Department.

† Occupations have been excluded in which less than 5 deaths occurred during the 4 months.

‡ Religious beggars.—W. B. B.

No.	Occupation.	Number of deaths in				Total.
		Sep.	Oct.	Nov.	Dec.	
25	Shoe and Boot-makers ... ..	...	1	5	14	20
26	Workers and sellers of Jute ... ..	...	5	1	...	6
27	Cow-keepers and Milk-sellers ... ..	...	2	1	4	7
28	Grain, Pulse and Flour dealers	9	15	9	18	51
29	Sweetmeat makers and sellers of pastry, cooks ..	...	1	1	10	12
30	Fruit and vegetable dealers ... ..	...	1	2	10	3
31	Grocers, Spice-dealers ... ..	...	..	1	4	5
32	Stone-cutters	1	...	...	4	5
33	Gold and Silver-smiths	1	...	1	9	11
34	Black-smiths ... ..	...	...	1	5	6
35	General labourers and coolies	18	66	50	185	319
36	Factory labourers (unspecified) ... ..	...	7	14	92	113
37	Shopmen, &c. (unspecified) ... ..	...	9	3	19	31
38	Mendicants ... ..	...	...	2	20	22
39	Males following no occupation	2	6	4	32	44
40	Females do. do.	12	50	34	171	267
41	Children, males	16	41	49	188	294
42	Children, females	2	28	29	131	190
Totals ...		77	299	257	1,205	1,838

TABLE VIII.
*The details of 27 Patients treated at Parel Plague Hospital with
M. Yersin's Anti-toxic Serum.*

No.	Initials.	Sex.	Age.	Caste.	Occupation.	Duration of Disease.	Serum in C. C.	Total C. C.	Result.	Remarks.
1	C. D. N. ...	M	51	N. C.	Medical Practitioner.	Days. 4-5	30+20	50	D	Double pneumonia.
2	D. P. ...	F	40	H.	Cooly ...	2	30+20	50	D	
3	D. N. ...	F	1½	N. C.	.....	2	10+10+10	30	R	
*4	R. T. N. ...	F	18	N. C.	.....	3	20+20	40	D	Meningitis and tumour (osseous) pressing on medulla found <i>post-mortem</i> .
5	S. B. ...	M	24	H.	Clerk ..	3-4	20+10+10+20	0	D	
6	S. B. K. ...	M	18	H.	Mill-hand ..	3-5	20+10	0	D	
7	P. D. ...	F	60	H.	... ..	2	30+30+40	100	D	
8	R. M. ...	M	25	H.	Mill-hand ...	2	30	30	D	
9	J. D. D. S....	M	13	N. C.	Schoolboy ..	36 hours.	40+40	80	D	Developed double pneumonia.
10	P. R. ...	M	7	H.	Do. ...	2	30+30	60	R	
*11	R. F. ...	F	25	N. C.	.....	.....	20	20	...	
12	M. D. ...	M	30	H.	Hamal ..	2	40	40	D	
13	R. M. ...	M	9	N. C.	Schoolboy..	1	40+40+40+40+30	190	R	
14	S. J. ...	M	9	H.	Sweeper ...	2	40+40+30	110	R	
15	B. J. ...	M	25	H.	Do. ...	2	30+40+40	110	R	
16	B. G. S. ...	M	28	H.	Clerk ...	36 hours.	40+50	90	D	
17	T. M. ...	M	18	H.	Mill-hand..	2	50+50+50+50+30	230	R	
18	M. S. ...	M	30	H.	Mali ...	26 hours.	4	40	D	
19	K. H. ...	M	22	H.	Massal ...	4-5	40	40	R	
20	L. R. ...	F	12	N. C.	... ..	3-9 hours.	40	40	D	
21	A. K. T. ...	M	60	N. C.	Merchant ..	9 hours.	40+50+50	140	R	
22	M. E. ...	M	45	Parsee.	Cook ...	3	60	60	R	
23	D. ...	F	11	Parsee.	.....	27 hours.	50	50	D	
*24	H. B. ...	F	32	Hindu Jain.	.....	7 "	50	50	R	I heard came from Charni Road Hospital.
25	C. M. ...	F	32	N. C.	.....	24 "	50+50	100	D	
26	K. B. S. ...	F	4	H.	.....	42 "	40	40	D	
*27	G. R. ...	M	52	H.	Clerk ...	3-5	20	20	D	Hepatitis and R. Fever. Injected at his own urgent request.

* These were not cases of plague.
Case No. 4 died of meningitis and should be excluded ; and mortality = 60·8 per cent.
2 cases developed sub-acute synovitis.
2 cases developed erythematous rashes on the skin. In one of these the rash persisted 2½ weeks.

II.—REPORT BY SURGEON-CAPTAIN L. F. CHILDE, I. M. S.

I.—ON THE POST-MORTEM APPEARANCES OF PLAGUE.

THE bodies examined were for the most part those of well-nourished adults of the servant and labouring classes. Usually the skin was found intact, except that there were cracks and abrasions about the hands and feet, resulting from occupation, and also in many cases marks of the common parasitic skin diseases, especially ringworm and itch; and although clinically various skin-lesions were met with, such as sloughing at the site of the bubo, boils and ulcers, yet in these cases recovery generally took place, and I had no opportunity of observing such conditions in the *post-mortem* room.

The following varieties of plague were met with :—

The Bubonic Form.

The Septicæmic Form or Plague-Septicæmia.

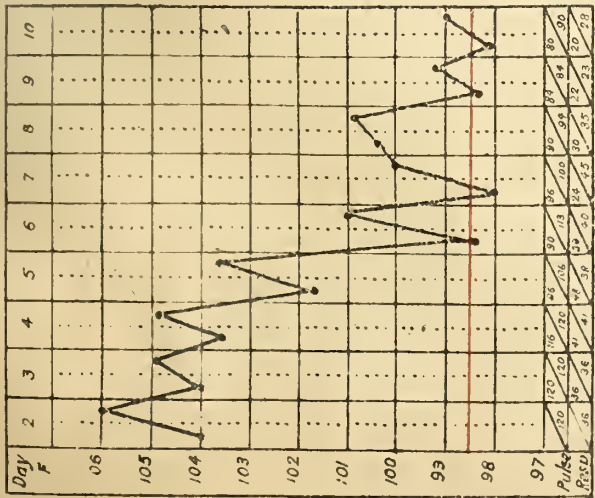
The Pneumonic Form or Plague-Pneumonia.

A.—THE BUBONIC FORM.

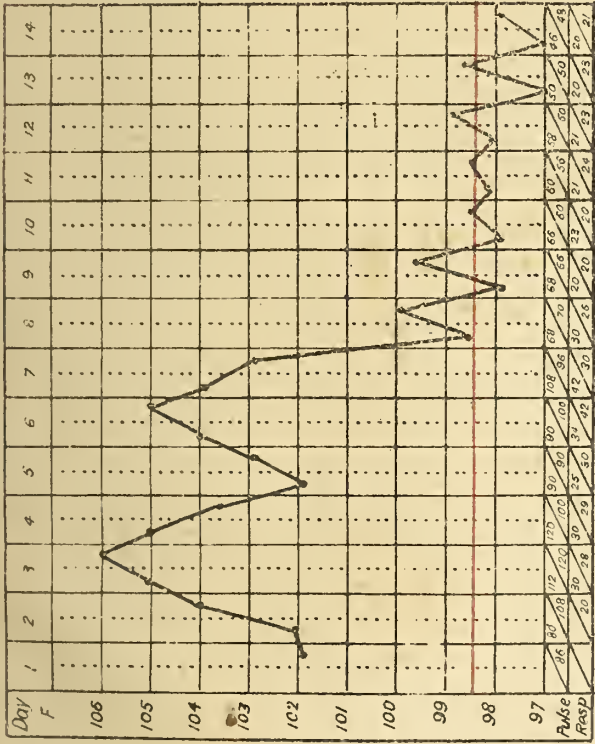
The bubo was usually situated in the groin of either side, less commonly in the axilla, rarely in the neck, and most rarely in the supra-trochlear or popliteal region; the limb corresponding to the bubo was swollen and œdematous and petechiæ were usually seen upon it, but they were always in greatest number over the site of the bubo itself; and though there might be some over the body generally, still these were but few. In the case of an axillary bubo, the whole axilla looked full and smooth, and the swelling extended down the side nearly to the margin of the ribs, down the inner part of the arm to the elbow, and over the anterior and posterior axillary folds. On dissection there was an enormous mass of dark coagulated blood and serum which occupied the whole axilla and included the glands, so that the whole mass had to be removed together; and on incision this was found to consist of the connective tissue of the part gorged with blood and of coagula due to hæmorrhages, whilst within were seen the glands. In recent cases, of four or five days' duration, there were some of a deep red and some of a lighter red colour, but all intensely engorged and solid, not breaking down, but a little soft from the amount of blood in them; whilst in older cases, of seven or eight days, the glands were softer, more pink in colour and almost diffuent, suggesting in fact the appearance of a rather soft spleen. The glands were rounded or oval in shape, and varied in size from a walnut to a pea. As a rule, too, the smallest glands were the deepest in colour and most solid, whilst the largest were of a lighter red colour and softer consistence. The axillary vessels were pressed upon and surrounded by the enlarged glands and extravasated blood, so that in fact they became incorporated in the bubo, and it was mainly by this pressure on the axillary vein that the œdematous condition of the arm, as referred to above, was produced. The hæmorrhage and coagula extended beyond the axilla and were found in the areolar tissue, as well as amongst the muscles, but more between them than in their substance; this condition also extended down the arm and could be seen in the areolar tissue as far as the elbow. There was also much clear œdema fluid which assisted in forming the swelling, and it was found in the axilla as well as beyond its borders. The bubo thus was found to consist, not of a single enlarged gland but of a chain of glands of various sizes, surrounded by a mass of engorged areolar tissue, coagulated blood and œdema fluid.

In the case of a bubo in the groin there was a similar diffuse swelling in Scarpa's Triangle extending to the neighbouring parts; whilst when the bubo was in the cervical

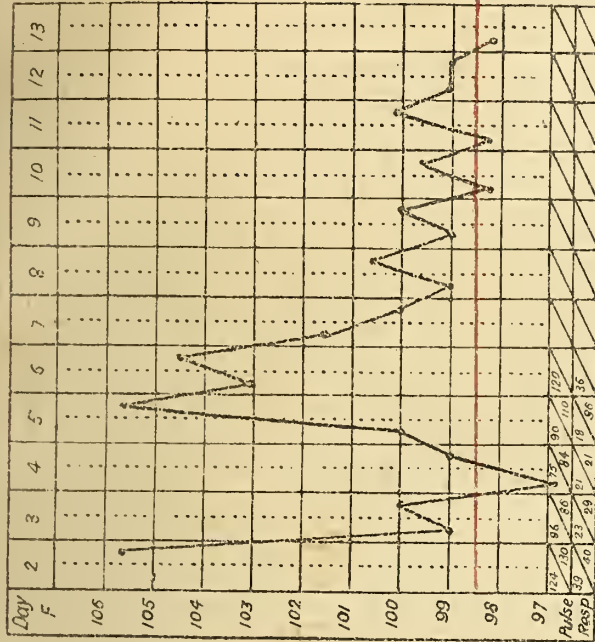
L (E) L Femoral Bubo Suppurated Rec



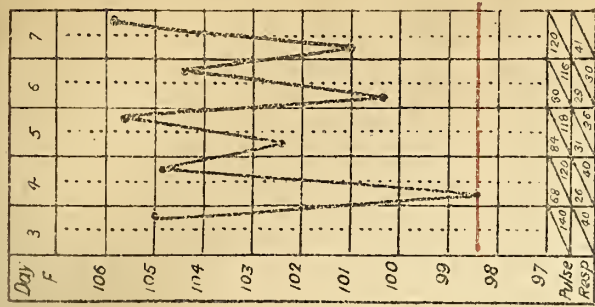
J. G. G. (E) L Fem. Bubo Suppurated Rec.



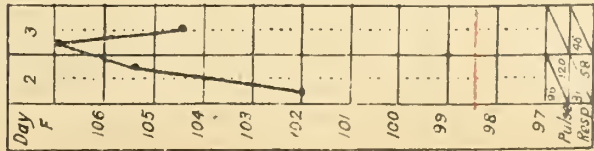
P. S. (H) L Fem. Bubo Suppurated Rec



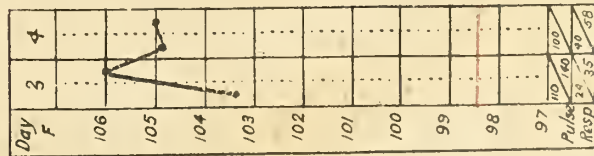
L. A. (H) L Fem. Bubo D



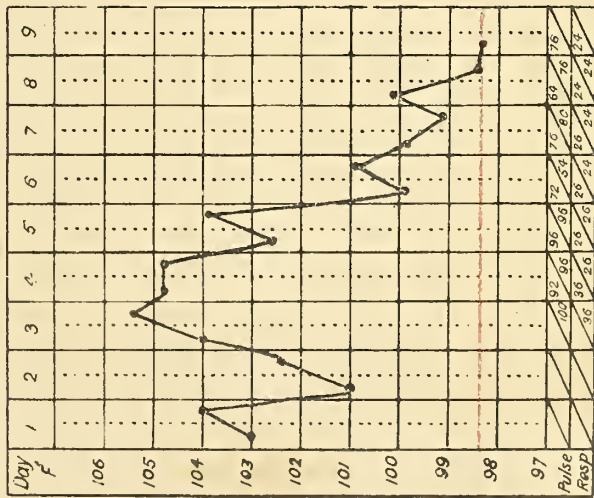
B. R. (H) D



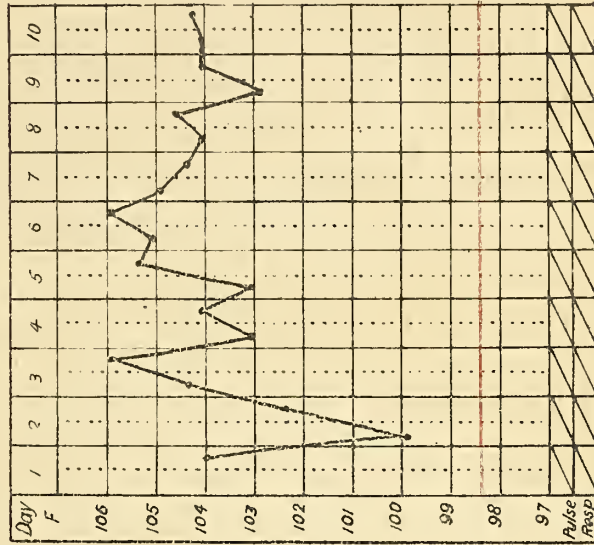
W. (E) L Fem: Bubo Resolution Rec.



K (H) R: Purot R: Axil L: Parot Suppurated 9 days after Haikines Prophylatic S. Rec



Typus Chart from Munderlich

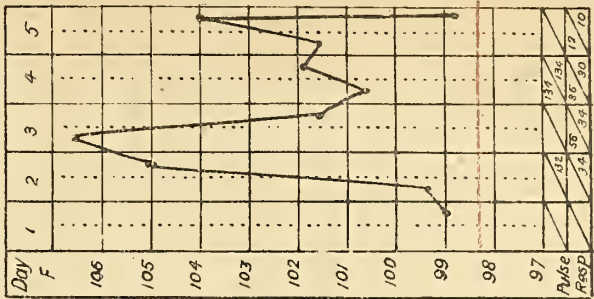


VII

IX

X

B. B. (H) R: Submax D.

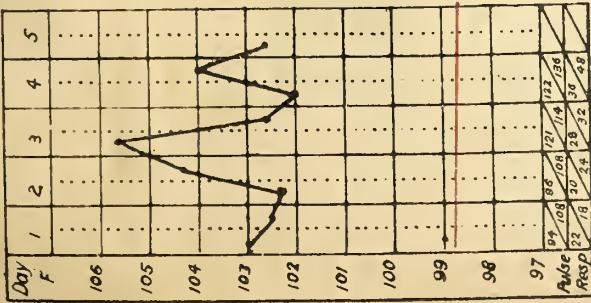


(E)=European (H) Ch=Native Christian (H) Hindu (L)=Left R=Right Rec=Recovered D=Died Letters at left corner = Patients Initials.

Charts I to X referred to in the body of Major Lyons' Report.

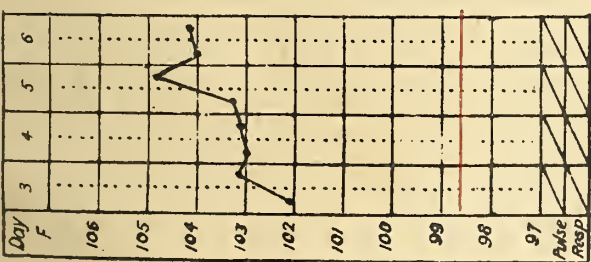
XI

R.M. (E) Br. Pneumonia. No Bubo D.



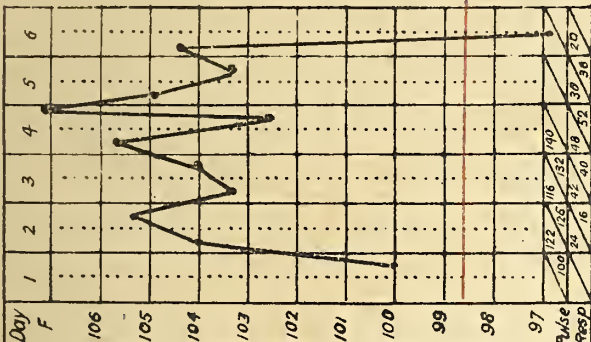
XIII

K.B. (H) Br. Pneumonia. No Bubo D.



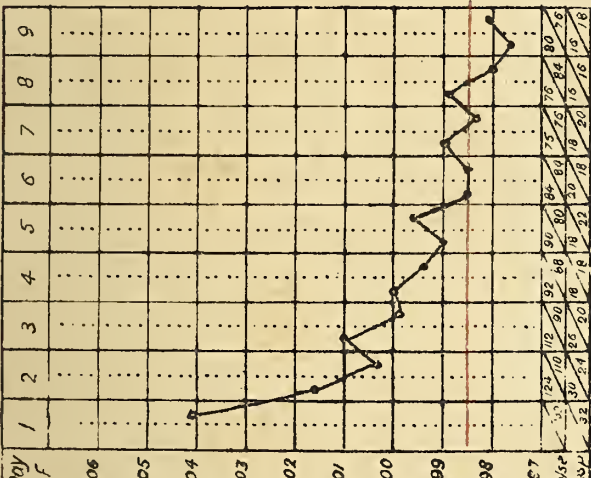
XIV

R.G. (H) R. Axil (Second Pneumonia) D.



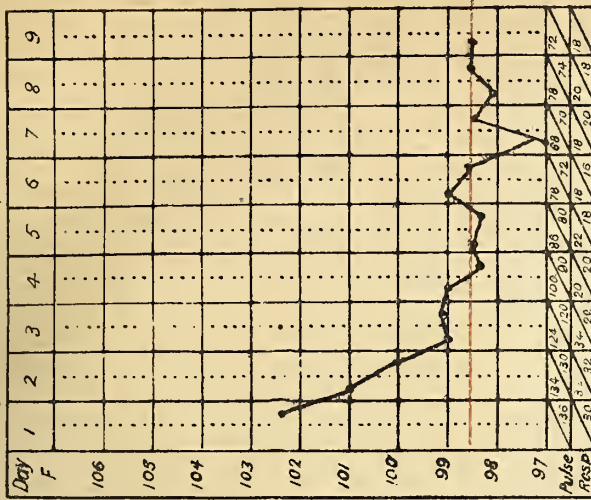
XV

K.L. (H) R. L. T. Fem Bubo Diarrhoea



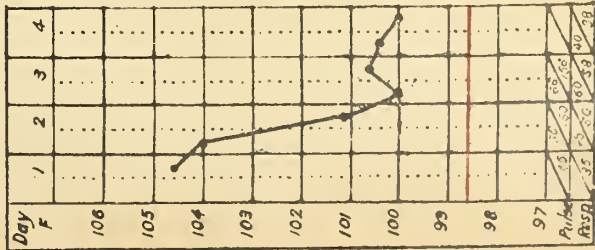
XVI

G.B. (H) R. Axil Bubo
3 days after Haffkines Proph Serum R.



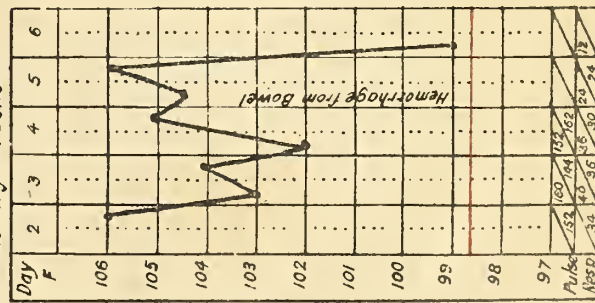
XVII

B.M. (H) Br. Pneumonia
No Bubo



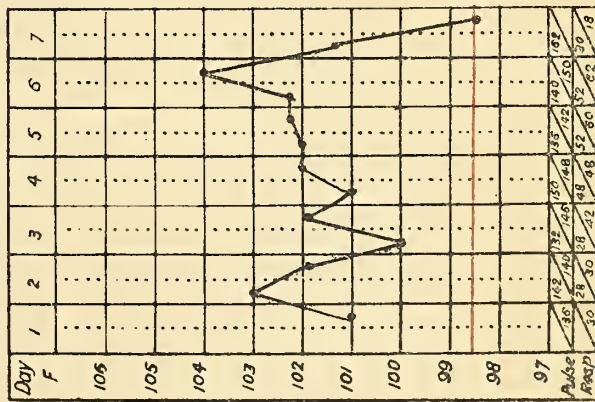
XVIII

W.Ch. (M) R. Fem. Bubo D.
Hemorrhage fr. Bowel.



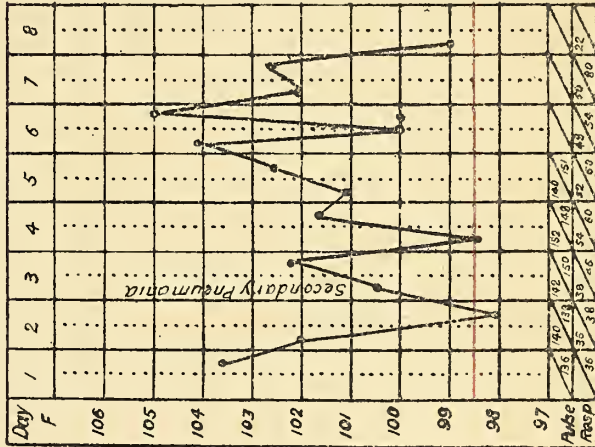
XIX

V.J. (H) Br. Pneumonia No Bubo



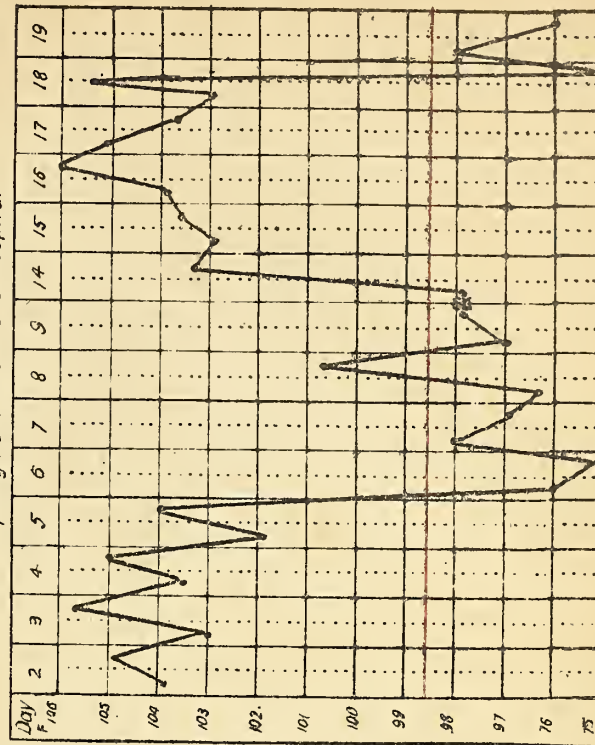
XX

A.K.H. (M) L. Axillary Bubo
Secondary Pneumonia D.



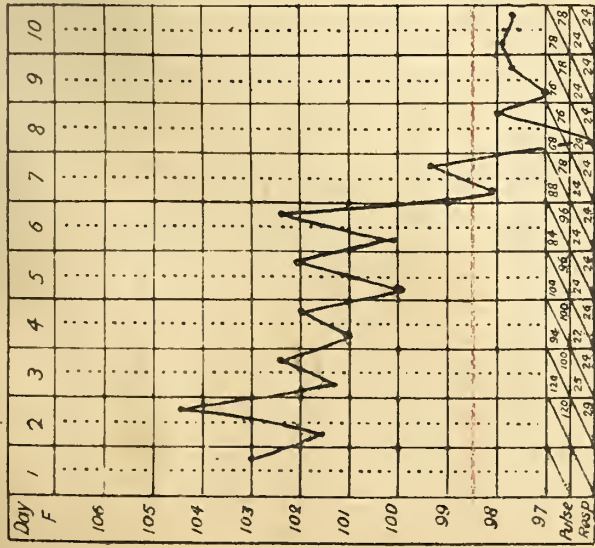
XXI

Relapsing Fever from J. J. Hospital

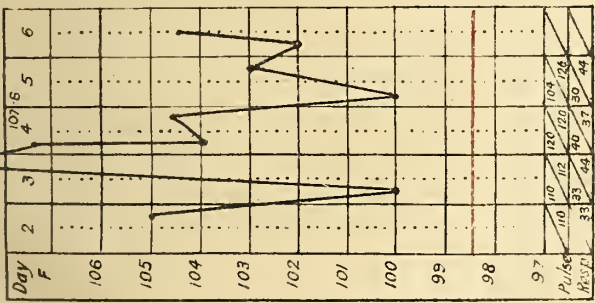


* days Temp (normal) omitted

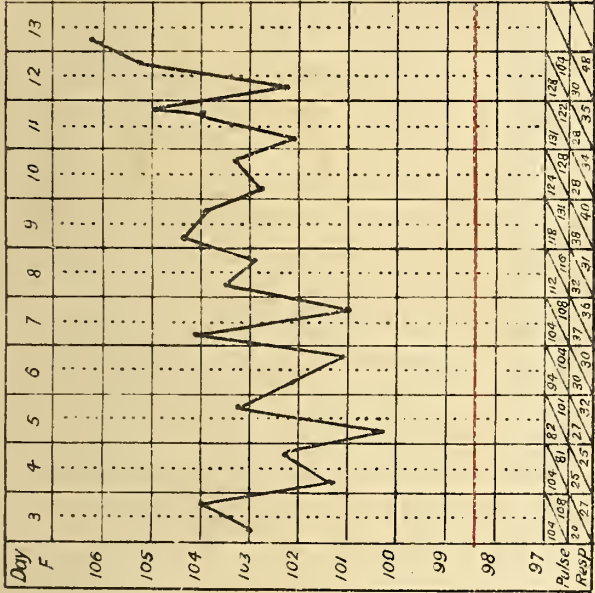
M. C. (E) L. Fem. Bubo Pregnant 2 Months Rec.



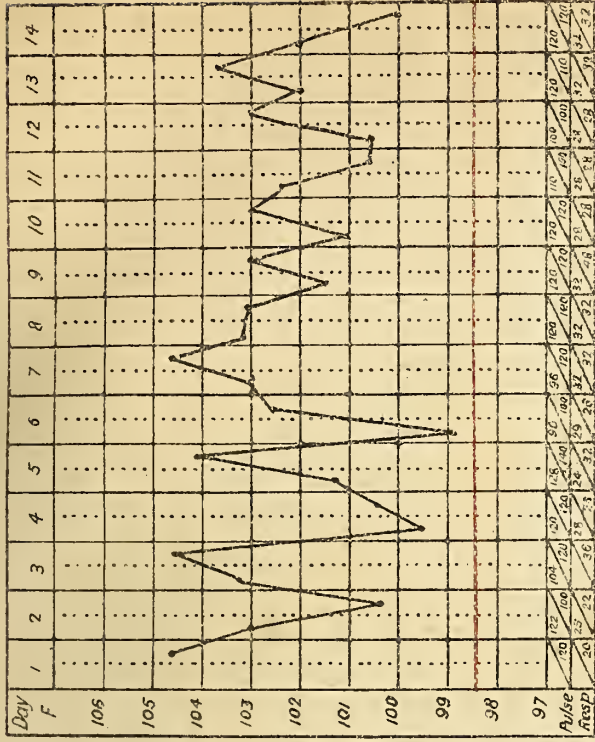
S.S. (N. Ch) L. Fem. Bubo chain of Glands D.



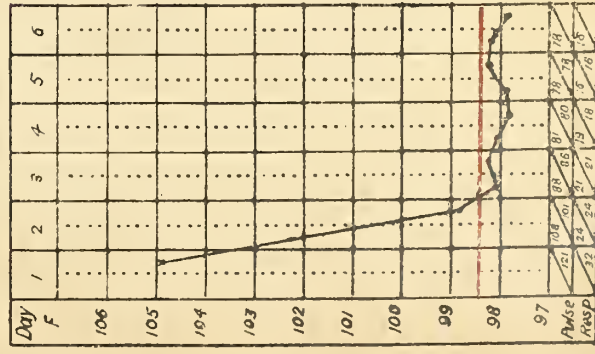
J. S. (E) No Bubo Enteric symptoms D.



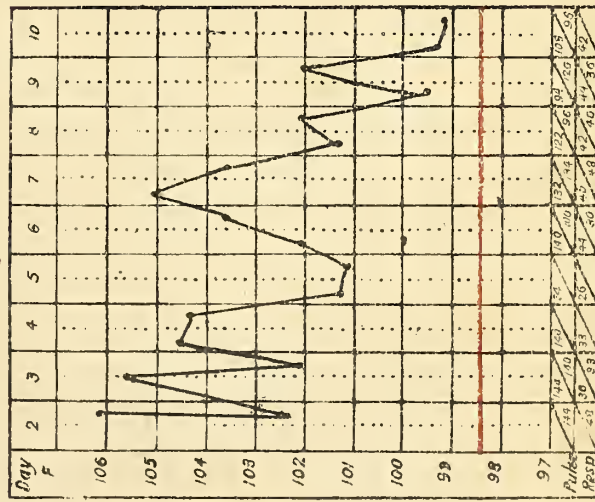
S. S. (Negro) Septicemic D.



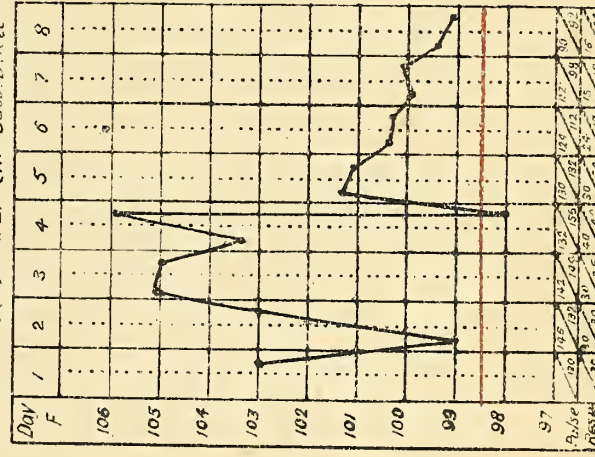
H. T. (E) R. Fem. Bubo Rec.



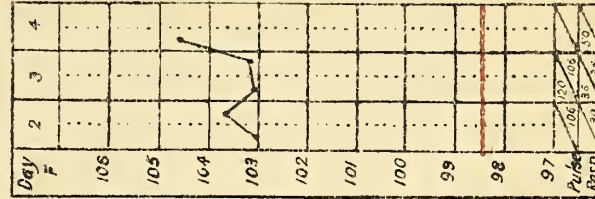
P. N. (M) Rec.



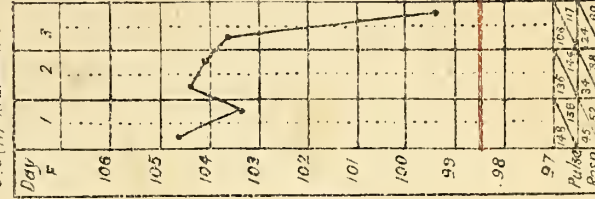
R. R. (H) R & L. Fem. Bubo D. Rec



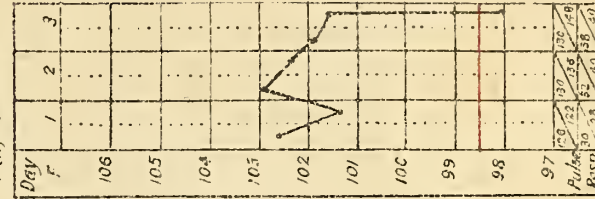
R. B. (H) Pneumonia D.



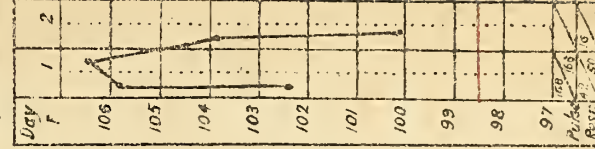
C. S. (H) Pneumonia D.



N. (H) Pneumonia D.



G. D. (H) L. Fem. Bubo D.



region this swelling was enormous, and pressed upon and embarrassed the larynx and trachea (hence the dyspnœa in these cases). With regard to the remaining lymphatic glands of the body in a bubonic case, there is but little to be said. Thus in the case of a left axillary bubo the following condition was found. The left supra-trochlear gland was intensely engorged and the size of a large bean, rather firm and full of dark blood; the right supra-trochlear, right axillary, cervical of both sides and bronchial looked normal or just *slightly* engorged. The mesenteric, iliac, lumbar and popliteal were in the same condition; whilst the inguinal were some as large as beans, pinkish, and slightly engorged, others of about the normal size and appearance. It may be mentioned here that the lymphatic vessels presented no abnormality as a rule, except that in some cases those near the bubo seemed to be slightly swollen; the thoracic duct, too, was either normal or possibly slightly swollen.

Condition of the other Organs.—Hæmorrhages were frequently found beneath the conjunctivæ, in the connective tissue under the scalp, and under the periosteum on the surface of the cranial bones, also extravasations sometimes of large size were occasionally found amongst the muscles, especially in those of the abdominal wall. The occurrence of petechiæ in the skin has been already mentioned.

Nervous System.—The dura mater and pia mater were much engorged, and the appearance of lymph was seen along the course of the larger vessels in the latter membrane; the puncta cruenta in the brain were well marked, but the brain substance itself looked normal, as did the fluid in the ventricles. The spinal cord presented a similar engorged appearance, but showed no other abnormality, and the nerve-trunks appeared to be normal.

Alimentary System.—The tonsils were either normal or enlarged to the size of almonds, of a dusky purple colour, soft and engorged; and similarly the pharyngeal tonsils were either normal or engorged. The parotid and sub-maxillary salivary glands were either normal or engorged to some extent, the mucous membrane of the pharynx and œsophagus was usually dusky from engorgement. The stomach showed constantly a distinctly engorged appearance with hæmorrhages into the mucous membrane, which were usually petechial, but sometimes of a larger size. Similar engorgement and petechiæ were frequent in the large intestine and rectum, but were less generally found in the small intestine. (This applies especially to petechiæ.) In some cases Peyer's patches and the solitary follicles looked distinct, prominent and slightly swollen; but usually they were either somewhat distinct or of the normal appearance.

The *Liver* was always distinctly enlarged and full of blood, but the substance itself was usually rather pale and soft from parenchymatous degeneration, there was bile in the gall-bladder either of the usual appearance or thin and watery. Hæmorrhages into the mucous membrane of the gall-bladder were rarely seen. In one instance small necrotic patches were scattered through the liver. This case will be described hereafter.

The *Pancreas* was either normal or engorged.

The *Spleen* was always enlarged, sometimes to two or three times the ordinary size, the capsule was normal, the spleen-pulp of a brick-red or purple colour and always markedly engorged. It was either fairly firm or rather soft, and the Malpighian bodies plainly seen as if each were engorged, so as to give the section sometimes almost a granular appearance.

Urinary System.—The kidneys were always enlarged and much engorged, the capsule stripped easily and petechial hæmorrhages were constantly found beneath it; the kidney substance itself was pale and soft from parenchymatous degeneration. There was distinct

engorgement of the pelvis of the kidney with petechial hæmorrhages and sometimes a large clot distending the pelvis and calices. The whole ureter was frequently engorged, and distinct hæmorrhages could be seen under its inner coat. The bladder was usually distended with urine, which was either of the normal or a slightly blood-stained colour; small hæmorrhages were frequently seen in the mucous membrane of the bladder.

The Genital System showed nothing abnormal beyond some engorgement.

The *suprarenal capsule* and *thyroid body* were engorged, but otherwise normal.

The *Peritoneum* showed considerable engorgement, and hæmorrhages into the retro-peritoneal tissue were frequently found; thus, they were seen on the under surface of the diaphragm, on the upper surface of the liver, especially close to the ligaments, and in one instance there was a hæmorrhage completely enclosing the gall-bladder, so that there was a casing of coagulated blood between the peritoneum and gall-bladder. Similar hæmorrhages behind the peritoneum were found on the surface of the spleen, kidneys, and intestines, and sometimes large coagula in the retro-peritoneal tissue of the lumbar region.

Circulatory System.—The pericardial cavity usually contained a few ounces of blood-stained or clear fluid, and petechial hæmorrhages were constantly seen beneath the visceral and parietal pericardium. The heart-muscle was either normal or in some cases rather soft and friable; considerable dilatation of the right side, with *post-mortem* clots in the cavities, was often present. There was not much engorgement of the walls of arteries, but the vena cava and other large veins showed this condition very markedly. On opening the veins distinct petechial and larger hæmorrhages were seen under the inner coat, giving it a mottled appearance. Where a large vein, *e. g.*, axillary or femoral, was included in the bubo, this hæmorrhage into its walls was constantly seen, so that the extravasated blood in the gland itself, in the areolar tissue outside it and in the walls of the vein, was all directly continuous. I think that the blood itself was rather more fluid and showed less tendency to clot than is usually seen after death.

The Respiratory System.—There was some engorgement of the larynx and trachea, and the mucous membrane of the bronchial tubes was usually swollen and engorged, sometimes greatly so. There was much general engorgement of the lungs with œdema, and small hæmorrhages into the lung tissue were seen rather frequently. Frothy sero-mucous fluid which was sometimes blood-tinged, was found in the bronchi. The pleura showed marked engorgement, and its cavity often contained some blood-stained or clear fluid; sub-pleural hæmorrhages, sometimes of large extent, were commonly found on the upper surface of the diaphragm, on the chest-wall, and on the surface of the lungs, especially between the lobes. In cases of cervical bubo the engorgement and œdema extended to the larynx, and œdema of the glottis was present.

Note.—A variety of the bubonic form of plague must be mentioned here; for, instead of finding one large bubo, such as has been described above, the following condition was observed: A chain of enlarged glands was found in the inguinal region and it extended into the pelvis right along the iliac artery as far as the lumbar glands. These glands were dark-red, soft and friable and intensely engorged, and looked like soft spleen tissue; there was great engorgement, extravasation, and œdema around them, and they surrounded the iliac artery and vein, so that in dissecting out the gland mass these vessels came away enclosed in it. The glands were as large as almonds or smaller, and were so incorporated in the coagulated blood that it was scarcely possible to dissect them out. The remaining glands and other organs in the body were in the condition described above.

B.—THE SEPTICÆMIC FORM, OR PLAGUE-SEPTICÆMIA.

In the bubonic form of plague, one set of glands with extravasated blood around them forms the bubo, and there is practically no alteration in the remaining glands of the body ; but in the septicæmic form there is no such bubo, yet there is a general involvement of nearly all the lymphatic glands. Yet though so many glands show evidence of disease, one gland or several glands of one set show characteristic changes which are pathognomonic of this type of plague. These appearances are : The gland is enlarged to the size of an almond or less, is rounded, firm, and pink in colour ; on section it shows some, but not much, engorgement and some œdema ; its substance is rather soft and can be easily scraped off with a knife, and sometimes small softening areas were present. There is no hæmorrhage in the areolar tissue around this gland and at most only a little œdema and trifling engorgement of the vessels. Commonly there were one or several such glands in one inguinal region, and usually the lowest gland of the chain was most markedly affected ; whilst those higher up varied in size from a bean to an almond, and had the same firm pink appearance, though there were at times some which looked nearly normal in size and shape. The iliac glands of the same side were similarly affected, as large as almonds, and either pink and firm or softer and of a dark-red colour. The inguinal glands of the opposite side showed similar changes, but sometimes to a less extent, and the iliac sometimes showed slighter changes or some of them looked normal. The lumbar usually showed slight enlargement and were either pale and soft or somewhat pink and firm. The cervical and axillary varied in size from hazel-nuts to peas, and usually showed merely engorgement, being full of dark blood ; but sometimes some of them showed the pink firm appearance described above. The mesenteric were enlarged to the size of peas and beans, and were either slightly or considerably engorged. The supra-trochlear and popliteal were normal or engorged. There was no hæmorrhage or œdema around any of the above-mentioned glands, and no enlargement of the lymphatic vessels was observed. The condition of the remaining organs was such as has already been described under the bubonic form.

Note.—In several cases of plague-septicæmia, where death had occurred shortly after attack, the glands were found slightly enlarged, of a dark-red colour and contained much blood and œdema fluid. This appeared to be an earlier form of the characteristic pink plague-glands described above. The difference between the bubonic and septicæmic form of plague appears to be this :—In the bubonic form the plague-bacillus after entering the body is arrested at the nearest group of glands, grows here vigorously, and as a result of its growth the bubo is formed. Here the bacillus forms the toxins which are discharged into the system and cause the symptoms of plague, but the glands of the bubo form a barrier which prevents the bacilli from passing on and growing generally throughout the body ; and it is only shortly before death, in fatal cases, that this resistance is overcome and the bacilli are able to pass on into the system generally. But in the septicæmic form, the bacillus, after entering the body, meets with feeble resistance at the nearest glands ; it speedily overcomes all opposition and passes on to infect other glands and organs where it grows abundantly. These points will be illustrated later in the detailed account of autopsies.

It may be mentioned here that no bubo of the mesenteric glands was ever found ; these glands were always examined, and though changes might be found in them, they were always less marked and less distinct than plague glands found in other parts of the body. In short, there was no autopsy, which went to show that the plague-bacillus had reached the stomach or intestine, *e. g.*, in food, and thence infected the mesenteric glands,

C.—THE PNEUMONIC FORM OR PLAGUE-PNEUMONIA.

In this form of plague the only marked evidences of disease are found in the lungs, whereas the lymphatic glands and other organs are scarcely affected at all. The lungs were in the following condition:—

Plague-Pneumonia.

There was general engorgement with considerable œdema, a reddened condition of the mucous membrane of the bronchi, but no marked evidences of bronchitis, and frothy watery fluid, sometimes blood-stained, could be squeezed from the bronchi. (Pus in the bronchial tubes was only found on one occasion.) A number of pneumonic patches were found scattered through the lungs, varying in size from a pea to an egg. These patches were light pink or red grey in colour, solid, airless and sank in water; they were rounded in shape and usually separated by a distinct ring of engorgement from the crepitant lung around. Some, instead of being pink, were of a deep blood colour throughout and less solid, and some of these had a small greyish more solid centre. Those of the patches which were situated on the surface of the lung were prominent and projected distinctly from the surface; whilst the pleura over them was roughened and showed signs of early inflammation. These patches had in fact the appearance of the first and second stages of lobular pneumonia, but no patches were found which had passed on to the third stage of softening and breaking down. In a few cases larger masses of pneumonic lung than these were found, and once about half the lower lobe was found in this condition. Petechial hæmorrhages were usually found on the surface of the lung, the bronchial glands were either enlarged, swollen, œdematous, soft and distinctly engorged, or else they were small and of the usual appearance, perhaps a little engorged. The remaining lymphatic glands throughout the body showed none of the appearances of either the bubonic or septicæmic form of plague; most of them looked absolutely normal, and the only noticeable change was that the axillary, and sometimes the cervical chains, were a little engorged.

The description of the remaining internal organs already given applies equally to this form of plague, except that the large hæmorrhages were absent, but petechiæ on the surface of the heart, in the pelvis of the kidney, bladder, stomach and intestines were commonly present. Petechiæ in the skin were not observed in this form of plague.

Reference must be made here to a variety of this form of plague which may be described as a combination of Plague-Pneumonia with Plague-Septicæmia. In this condition the lungs were found in the state which has just been described, pneumonic patches being scattered through them; and in addition the lymphatic glands of the body presented the appearances seen in cases of Plague-Septicæmia. Thus in these cases the plague-bacilli had specially infected both the lymphatic glands and lungs, whereas in the varieties of plague, treated of above, only one or other of these tissues was the special focus of disease.

II.—MICROSCOPIC PATHOLOGY OF PLAGUE.

A.—THE BUBONIC FORM.

The areolar tissue round the glands of the bubo is intensely engorged, free hæmorrhage is seen in the areolar tissue and fat, and all the vessels visible are full of blood, and their walls deeply engorged. The glands are uniformly full of extravasated blood throughout, with more intense hæmorrhages here and there, and the gland tissue is so overlaid with blood as to be scarcely visible; in some, probably earlier, glands the blood-cells are distinct; in others, probably older, they are not so distinct, and the gland is stained with blood-colouring matter, softer, showing granular debris, and beginning to break down

in parts. Still there is no distinct appearance of pus, and it seems to be a necrotic softening. In some of the smaller glands the exact early appearance is seen; the whole gland is infiltrated with blood, the blood corpuscles being distinct, and at parts there is a large deeply-stained hæmorrhage occupying half or more of the gland. So intense is the hæmorrhage that in most glands there is no distinction between cortex and medulla, nor can the gland tissue or blood and lymph-vessels be easily made out, but the walls of such vessels as are seen are deeply engorged both in the glands as well as at the hilus. Such lymph-vessels, as can be seen, particularly at the hilus, are full of lymph corpuscles, and there is some engorgement of their walls, and sections of the lymph-vessels, seen outside the gland, shew the same appearance. Specimens were cut to shew the glands of the bubo lying against and around the axillary artery and vein; here there is intense engorgement of the walls of these vessels with hæmorrhage into them, but much more of the vein than of the artery; in the vein the extravasated blood comes in most parts right through its wall into the inner coat and as far as the lumen; so that at these parts the inner coat cannot be properly seen at all. Hence one sees the plague-gland lying right against the vein, with extravasated blood in the gland, in the little connective tissue outside it, and then in the vein-wall as far as the lumen; and thus there is a direct path for the passage of the plague-bacillus from the gland to the lumen of the vein and so into the general circulation. A similar condition of affairs was observed in those cases in which, instead of a bubo, there was a chain of enlarged plague-glands, *e. g.*, along the iliac artery and vein. The remaining glands of the body in a bubonic case showed either a normal appearance or a little engorgement of vessels.

Lung.—A section of the lung shows blood-cells in all the vessels as well as in the alveolar capillaries; the vessels under the pleura always contain blood, and large hæmorrhages are sometimes present here; scattered about, arcas are seen where blood-cells are present in the alveoli themselves, and similarly blood-cells may be seen in the smaller bronchial tubes. The vessels of the walls of the bronchi, like those of the rest of the lung, are distended with blood; the bronchial mucous membrane shows no special change. Specimens of lung stain well.

Liver.—All vessels are engorged and the specimen has the appearance of early nutmeg degeneration. The central veins are wide, as are the capillaries round them, and the portal veins are also distended with blood-cells; around the distended central and portal veins there is fine granular pigmentation of the liver cells. Engorged vessels are usually seen well just beneath the capsule of the liver, and there may be hæmorrhages here. The nuclei of the liver-cells stain badly and the cells have a cloudy indistinct appearance as of parenchymatous degeneration.

Spleen.—The vessels generally, both large and capillary, are distended with blood-cells, and this is more marked in certain distinct areas; here a dilated vessel is seen full of blood, and round it an area of engorged capillaries, with hæmorrhage into the spleen tissue, blood-cells being seen amongst the spleen-cells. Engorged vessels are also seen in some glomeruli, and a vessel distended with blood leading to the glomeruli; further distended vessels with hæmorrhages around them are usually well marked under the capsule of the spleen. Section of spleen stain well and the cells are distinct.

Kidney.—The vessels, both large and capillary, are distended with blood-cells at places, vessels have ruptured and hæmorrhage is seen into the kidney substance. This condition is marked immediately beneath the capsule. Blood-cells are seen in many of the tubules.

but more so in the straight than in the convoluted tubes, and some of the glomeruli are likewise engorged. The epithelium of the tubules is swollen and in a condition of parenchymatous degeneration, and the nuclei of the cells stain badly; but this condition is more plainly seen in the convoluted than in the straight tubes. Some specimens show engorged vessels with hæmorrhage at the pelvis of the kidney.

Ureter.—The vessels of the walls of the ureter are distended with blood, and hæmorrhage has occurred into the walls, blood-cells being seen in the mucous membrane even as far as the lumen; the condition is similar to that found in the walls of veins.

Stomach and Intestines.—The vessels are distended with blood, this condition being best seen in the sub-mucosa; at places small hæmorrhages have occurred. The epithelium does not stain well. Nothing abnormal was seen in Peyer's patches.

Brain and Spinal Cord.—The large vessels and capillaries of the pia mater are distended with blood, but no special changes have been seen in the substance of the brain or spinal cord.

Muscle.—In specimens of voluntary muscle some fibres are seen well stained and distinctly striated, but mixed with them are others which are badly stained, with striation faint or absent, and the muscle-substance is swollen, broken up into irregular lumps and of a shiny homogeneous appearance. Specimens of the *heart-muscle* showed this condition also.

Note.—This degeneration of heart-muscle is associated with the dilatation of the heart and nutmeg condition of the liver found *post-mortem*; and also with the fact that plague-patients are liable to die suddenly of heart-failure.

Blood-vessels.—In the outer coat of *large arteries* the blood-vessels are found full of blood, and the capillaries of the middle coat may also be seen distended; but the inner coat is always perfect, distinct and intact, and its elastic tissue plainly visible. The walls of *large veins*, however, show much more engorgement, and in these, large collections of blood may be seen immediately beneath the inner coat, extending as far as the lumen, and at parts the inner coat is either extremely thin or cannot be traced over the hæmorrhage. This condition is best seen in vessels incorporated in a bubo, but is also to be found in the vena cava, iliac veins, &c.

The following organs were also examined, but nothing was observed under the microscope, except some engorgement: The tonsils, salivary glands, thyroid body, breast, male and female generative organs, cartilage, nerve and thoracic duct. Sections of the skin were also made, and showed engorged capillaries with small hæmorrhages, where petechiæ were visible on the surface.

B.—THE SEPTICÆMIC FORM.

Lymphatic Glands.—The areolar tissue around the plague-glands (*i. e.*, the characteristic glands already described) shows none of the intense engorgement seen in the bubonic form. The plague-glands themselves are well stained and all their anatomical features are distinct. All the blood-vessels in the gland are distended with blood-corpuscles, and at parts hæmorrhage has occurred into the gland-substance, which is most frequently seen beneath the capsule, but may also be at other parts. The lymphatic vessels and lymph channels in the gland are wide and distended with lymph-corpuscles. The distension of the blood and lymph vessels is always most marked at the hilus, and there may be hæmorrhages into the areolar tissue here. In some glands small areas may be seen, where softening and breaking down is

taking place, granular débris and broken-down cells being seen here. The glands show these changes in varying degree; in some there is merely slight engorgement with some distension of lymph-vessels, in others there is wide distension of both kinds of vessels, with some amount of hæmorrhage into the gland tissue; whilst in others again there are many hæmorrhagic areas which may occupy half or more of the gland, and it is in these glands that breaking down is usually seen. In a septicæmic case, the glands which have not the characteristic plague appearance, shew under the microscope either slight engorgement or normal features.

With regard to the remaining organs, the appearances described under the bubonic form apply also to the septicæmic form of plague.

C.—THE PNEUMONIC FORM.

A section of lung-tissue, apart from a pneumonic area, shows great engorgement of all large blood-vessels, and of the alveolar capillaries as well, and patches of hæmorrhage into the alveoli around these engorged vessels are seen scattered about. In a pneumonic area three zones can be made out. At the circumference there is intense engorgement of all vessels, including alveolar capillaries, the alveoli are full of blood, and the hæmorrhage is so intense that many of the alveolar septa are broken down, entirely absent, or represented by mere shreds. Within the circumference is seen a zone, in which the alveoli are intact and are completely filled with well-stained cells, so that there is no interval between the alveolar walls and their contents; and at the centre is one universal mass of similar cells, and the cellular infiltration is so extreme that the walls of the alveoli are scarcely visible. Such is the general arrangement of the pneumonic patch, although there may be alveolar hæmorrhage in parts of either the middle or central zone.

Under a higher power the alveoli of the circumference are seen to be completely filled with blood corpuscles, and there is scarcely any appearance of fibrin, or none at all; in the middle zone the alveolar contents consist for the most part of catarrhal epithelium with some white and a few red blood-corpuscles, and a little fibrin or none at all, whilst the dense central mass of cells consist of catarrhal epithelium and leucocytes with some granular débris. Thus the pneumonic area has the appearance of very extreme lobular or catarrhal pneumonia.

The walls of the bronchial tubes, as well as of the large veins, show great engorgement, and there are hæmorrhages into the vein-walls. Blood and catarrhal cells may be seen in the finer bronchi, but the bronchial mucous membrane is scarcely altered, there being at most a little cellular proliferation. There are the appearances of acute pleurisy over those pneumonic areas which project upon the surface of the lung, with hæmorrhages beneath the pleura.

The bronchial glands show engorgement of blood-vessels, some hæmorrhage into the gland-tissue and distended lymphatic vessels; but in some cases these conditions are only slightly marked and the glands looked nearly normal. The remaining lymphatic glands in the body looked either normal, or presented the characters described above to a slight extent.

With regard to the other organs, the description given under the bubonic form of plague applies here also, except that generally engorgement and hæmorrhage are less marked.

D.—THE PLAGUE-BACILLUS *IN SITU*.

Sections of the various organs and lymphatic glands were prepared to show the plague-bacillus *in situ*; they showed best when stained with Löffler's methylene blue or carbolfuchsin, but they could not be demonstrated with Gram's method.

In the glands of the bubo the bacilli could be seen in enormous numbers, both amongst the cells of the gland-tissue and also in the lymphatic vessels; they were also seen amongst the blood-corpuscles extravasated into the gland, as well as in the hæmorrhage outside the gland. In case of plague-septicæmia they were similarly present in the enlarged characteristic glands. In the kidney the bacilli could also be seen, especially among the blood-cells of the tubules into which hæmorrhage had occurred: in the spleen they were also present, sometimes in large numbers amongst the cells of the spleen-tissue and in the hæmorrhagic areas; similarly they were found in the liver, especially in those cases where engorgement and extravasation were marked.

In case of plague-pneumonia, the bacilli were seen in abundance in the pneumonic areas; they could be found in profusion amongst the catarrhal epithelial cells and leucocytes which filled the alveoli and terminal bronchioles, as well as among the blood-corpuscles of the alveoli into which hæmorrhage had occurred. Similarly in the lungs of non-pneumonic cases they could be seen, but in far less numbers, and mostly where small hæmorrhage had occurred into the alveoli.

Note.—These specimens were only prepared from cases where the *post-mortem* was made immediately after death, and in which the presence of the plague-bacillus had been proved to be present by the method of cultures, so as to avoid the fallacy of diagnosing plague-bacilli from their microscopic appearance alone.

III.—CASES TO ILLUSTRATE THE VARIOUS FORMS OF PLAGUE.

A.—THE BUBONIC FORM.

Bubo in the Left Axilla.—R. N., male, Hindu, aged 40 years, admitted 1st March 1897, says he got suddenly ill four days ago with fever and severe rigors; temperature on admission 104·8 F., pulse 110, has pain in left axilla. March 2nd.—Temperature 103·2, pulse 110, still pain in left axilla, and swollen glands are felt. During the day a large doughy, diffuse swelling arose in the axilla, and there was much more pain. March 3rd.—Temperature 100, the swelling filled out the whole axilla and was very painful. Patient died at 9-30 A.M.

Post-mortem examination one hour after death.—Edema and petechiæ of left arm; old abrasions on hands and feet; large swelling in left axilla, with small petechiæ on the skin over it. The whole of the left axilla was occupied by a mass of coagulated blood and serum, and within the mass the axillary glands were found; they varied in size from almonds to peas, and were all intensely engorged, deep or lighter red and a little soft; the axillary vessels were included in the bubo thus formed of coagula and swollen glands. The hæmorrhage and edema extended beyond the borders of the axilla in all directions.

Left supra-trochlear gland intensely engorged and the size of a large bean.

Right supra-trochlear, right axillary, and cervical chains on both sides were a little engorged, but of normal shape; the popliteal were normal; the inguinal were some as large as beans, and some smaller or of normal size; they were all slightly engorged, on the right side rather more than on the left. The iliac and lumbar were a little engorged, and the mesenteric slightly so, the bronchial glands looked normal. There was no hæmorrhage or edema round any of these glands.

Heart.—Some sero-sanguineous fluid in pericardial cavity and small sub-pericardial petechiæ; dark blood in cavities of heart, mostly on right side. Hæmorrhages into walls of vena cava seen well under inner coat.

Lungs.—A little blood-stained fluid in pleural cavities, many sub-pleural hæmorrhages of petechial and larger size. Intense engorgement, with some hæmorrhages into lung-tissue and some œdema of lungs.

Liver.—All vessels, large and small, both hepatic and portal, gorged with blood; liver-substance rather soft; large sub-peritoneal hæmorrhages on the surface of the liver, specially along the ligaments.

Tonsils.—Swollen and engorged; mucous membrane of stomach and intestines engorged, and small hæmorrhages in stomach and large intestine. Hæmorrhages under serous coat of intestines.

Spleen.—Large, brick-red and somewhat soft, and many small hæmorrhages under its serous coat.

Kidneys.—Large, and all vessels engorged, the kidney-substance itself rather pale and soft. Many small hæmorrhages under the kidney-capsule, and coagula distending the pelvis of each kidney. Hæmorrhages into walls of ureters, and bladder distended with urine.

Distribution of the Plague-Bacillus.—In this case the plague-bacillus was found in the various organs as follows:—It was present in enormous numbers in the glands of the bubo and in immense but diminished numbers in the blood, as well as the œdema fluid from the left axilla. The right axillary glands, the supra-trochlear and cervical of both sides showed a considerable number of plague-bacilli, but far less than the bubo. The lumbar also showed them in considerable numbers, but they were rather less in the iliac and inguinal chains of both sides. A few were seen in the mesenteric glands. A specimen of blood taken from the left ventricle of the heart and from various large veins in the body showed many plague-bacilli, but far less than in the blood taken from the bubo. Immense numbers were found in the spleen and liver, almost as many as in the glands of the bubo; and some, but far less, in the lung and kidney.

In point of fact it appeared from these specimens that the bacillus had grown most abundantly in the glands and blood of the bubo, and next in the spleen and liver; whereas in the remaining lymphatic glands and other organs it was present in about the same numbers as in the blood of the general circulation, and the bacilli seen in these specimens were probably those contained in the blood of the respective organs. Possibly it might have grown to some extent in some of the lymphatic glands, as indicated by the above specimens.

Note.—In a case of this nature, where there is extravasated blood around the glands of the bubo, which extends through all the coats of the large vein (the axillary in this instance), and where there are enormous numbers of plague-bacilli in this extravasated blood, there appears to be a direct path for the passage of the plague-bacilli into the lumen of the vein and so into the blood of the general circulation.

B.—CASE OF A BUBO EXTENDING ALONG THE ILIAC VESSELS.

M. R., Hindu, male, aged 27 years, admitted January 26th, 1897, says he has been ill two days. The left inguinal glands are large, painful and tender, and the left leg is swollen, is much exhausted, and died one hour after admission.

Post-mortem examination made three hours after death. Body well-nourished, *rigor-mortis* present.

The Left Inguinal Glands were as large as almonds, rather soft, red and distinctly engorged; the lower ones showed this condition markedly, but some of the higher to a less extent. There was no hæmorrhage around these glands.

The Left Iliac Glands were all dark red, soft, friable and intensely engorged and looked like soft spleen-tissue; there was great engorgement, extravasation, and œdema around them and they surrounded the iliac artery and vein, so that the whole mass of coagula, glands and vessels had to be removed together. There was no rounded bubo as in the former case, but a chain of swollen glands with hæmorrhage around them extending along the vessels.

Lumbar Glands.—The lower ones were rather large, soft and engorged, but much less than the iliac, and there was but little extravasated blood around them. The upper ones showed even fewer changes, and some looked normal.

The Right Femoral and Right Iliac Glands were normal. The remaining glands looked normal, except that the right axillary were engorged, two of them being as large as almonds, and the right supra-trochlear was likewise engorged to the size of a large pea.

With regard to the remaining organs, the heart showed some dilatation of the right side, and the lungs a great deal of engorgement and œdema; there were petechiæ under the pleura and pericardium. The liver and spleen were both large, dark and full of blood, and the kidneys large, soft and engorged. There were some petechiæ in the stomach, and the brain and its membranes were engorged.

Distribution of the Plague-Bacillus.—The enlarged left inguinal glands contained plague-bacilli in considerable numbers which were found to stain well; specimens of the left iliac glands showed them in immense numbers, as did those from the lower lumbar glands, but the higher lumbar showed less. The right inguinal and iliac, the axillary and cervical of both sides and the bronchial glands showed only a few plague-bacilli, but of this series the right axillary specimens showed rather more than the others. The lung, liver, spleen and kidneys similarly contained a few, as did the specimen of blood taken from the heart; in fact, apart from the bubo the remaining lymphatic glands and organs merely showed about as many plague-bacilli as the blood.

C.—THE SEPTICÆMIC FORM.

P. S., Hindu, male, 30 years old, was admitted on the 19th February 1897. His friends said he had been ill with fever for about four days and had been delirious for one day. He died immediately after admission. The *post-mortem* examination was made one hour after death. No petechiæ on surface of body.

Lymphatic Glands: Right Inguinal.—The lowest was the largest, of the size of a small almond, and of the others, some were nearly as large and some smaller; they were rather firm and pink and of the characteristic plague appearance.

Left Inguinal.—The lowest was like a small almond, those above quite small, and the highest as large as beans; all were slightly firm and pink, but in an earlier stage than on the right.

Right Iliac.—The three lowest were like large almonds, pink and firm, but the upper were smaller.

Left Iliac.—The lowest was like a small almond, but red and full of blood and rather soft, the upper ones were like small beans and less engorged. The *Lumbar* were like small peas and beans, all rather red and firm. The *Mesenteric* were enlarged to the size of small almonds, beans and peas, and were all dark red, engorged and soft. The *Right and Left Axillary* were light red in colour, and rather firm, some being as large as hazelnuts and some smaller. The *Cervical* chains showed a similar appearance, whilst the *Supra-trochlear* and *Popliteal* glands were small and pale.

There was no inflammation of lymphatic vessels and no hæmorrhage or œdema round the glands in this case, so that there was no appearance like the bubo described in former cases. The condition of the remaining organs was such as has been already described, and it only remains to notice that there were many small hæmorrhages in the lungs.

Distribution of the Plague-Bacillus.—Specimens taken from the inguinal, iliac and axillary glands of both sides showed enormous numbers of distinct plague-bacilli which took the stain well; specimens of the lumbar and mesenteric glands showed the same appearance. The cervical glands showed them also, but in less numbers, and the bronchial, supra-trochlear and popliteal glands still less. A large number of specimens to show the bacilli were made from the glands of each region, and, as a general rule, those glands which were largest and most distinctly altered showed the greatest number of plague-bacilli. Specimens of the spleen contained many of the bacilli, but less in number than the plague-glands. The liver and kidneys showed plenty, but fewer than the spleen, and the lungs still fewer. The blood contained a fair number, about as many as in the lung.

Note.—In this case the mesenteric glands showed distinct changes and contained many plague-bacilli, but in some other cases of this type these glands were only slightly altered and presented a few plague-bacilli: and, as a general rule, the peripheral glands were most obviously altered and contained the bacilli in the greatest numbers, whereas the visceral were more normal-looking and showed the bacilli only in small numbers.

D.—THE PNEUMONIC FORM.

R. F., Hindu, male, 23 years old, admitted on January 31st, 1897, complaining of fever and cough of four days' duration. He looked very ill, temperature 102, and he had dyspnoea and cough. There were physical signs of pneumonic patches in the lungs. He complained of no pain whatever, nor was any enlargement of lymphatic glands made out. He remained very ill and died on February 2nd. *Post-mortem* examination seven hours after death. No petechiæ on surface of body, body well-nourished and plenty of subcutaneous fat.

Heart.—Muscle rather soft and flabby and dilatation of the right side with slightly coagulated blood in the cavities.

Lungs.—Much general engorgement and œdema of lung-substance, some congestion of bronchial mucous membrane, with frothy sero-mucous fluid in trachea and bronchi. Distinct rounded nodules in the early second stage of pneumonia were distributed in the lungs as follows:—There were five such nodules in the right upper lobe, varying in size from a hazelnut to an egg, and a few in the rest of this lung, with one mass quite at the base; also the left lung contained a few similar pneumonic patches. Those on the surface projected and there was early pleurisy over them, also petechiæ under the parietal pleura generally. The nodules were surrounded by a ring of engorged lung in the first stage of pneumonia. The liver, spleen and kidneys were large and engorged, and the bladder full of urine; the intestines rather engorged with some petechiæ in the stomach; the brain and its membranes engorged.

Condition of Lymphatic Glands.—*Bronchial*, enlarged and a little swollen and engorged.

Cervical, normal; *Axillary* a little swollen, mostly on the right side.

Supra-trochlear and Popliteal, normal.

Inguinal, slightly enlarged.

Iliac, Lumbar and Mesenteric, normal.

Distribution of the Plague-Bacillus.—The pneumonic lung in the second stage shows immense numbers of bacilli which took the stain well, and some of them are collected into large masses or groups; the pneumonic lung in the first stage shows the same appearance, but not so many of the masses. The general lung-tissue shows many of the bacilli, but far less than the pneumonic patches. The fluid obtained from the trachea and bronchi also shows the bacilli in large number. The bronchial glands contained plague-bacilli in considerable numbers. The spleen showed a few, the liver rather more, and the kidneys still more, but nothing like the numbers in the lungs. The blood of the general circulation showed extremely few, just one here and there.

The axillary and cervical chains, the lumbar, iliac, mesenteric and inguinal glands showed extremely few, only one here and there as was seen in the blood. Thus the plague-bacilli were present in enormous numbers in the lungs and only to a very slight extent in the lymphatic glands and remaining organs.

Note.—In some other cases of the pneumonic form of plague, fewer of the bacilli were seen in the bronchial glands and kidneys than in this instance.

E.—PLAGUE-PNEUMONIA WITH PLAGUE-SEPTICÆMIA.

K. B., Hindu, 31 years of age, was admitted on February 23rd, 1897, for fever and cough, said to be of five days' duration. He was extremely ill and there were physical signs of pneumonic patches in the lungs; also enlarged glands could be felt in the groins and axillæ. His temperature varied between 103 and 105, delirium set in, and he died on February 26th. *Post-mortem* on February 27th, twelve hours after death; there were no petechiæ on the skin.

Heart.—Right side dilated, muscle rather soft.

Lungs.—Much blood-stained watery fluid in trachea and bronchi, much general engorgement and œdema of lungs. There were many distinct, solid pneumonic patches, each surrounded by a well-marked ring of engorgement; six such patches in the right lung and five in the left. The patches on the surface had early pleurisy over them, and there were sub-pleural petechiæ. There were also five or six areas of mere engorgement, not consolidated, but full of blood and of intense purple-red colour; they were patches in the first stage of pneumonia.

Bronchial Glands, rather engorged and soft.

Liver, Spleen and Kidneys, large and engorged.

Stomach and Intestines engorged and showing some petechiæ.

Lymphatic Glands: *Right Popliteal,* two the size of beans, rather red and firm, the left one normal.

Inguinal on both sides. The lowest were the largest, like walnuts, partly red, partly cream-colour, all rather firm; the upper were all smaller, like beans, some being red and some pale.

Iliac.—The lowest on each side was like a large almond, the others like beans; all were of a cream colour and rather soft.

Lumbar.—Pink, soft and as large as beans, some of them almost defluent.

Mesenteric.—Some normal, some as large as beans and slightly red.

Supra-trochlear.—Right, the size of a large bean, purple-red, engorged and firm. The left was normal.

Cervical.—The highest on each side was like an almond, swollen, firm and deep-red ; of the lower ones some looked normal and some engorged.

Axillary, as large as hazelnuts, beans and peas, the larger ones being much engorged and the smaller less so.

There was no hæmorrhage, engorgement or œdema of the areolar tissue around these sets of glands respectively.

Distribution of the Plague-Bacillus. Lung.—Second stage of pneumonia ; enormous numbers of plague-bacilli ; first stage of pneumonia, plenty, but not so many as above ; and in general lung tissue far less.

Fluid in Trachea and Bronchi.—Enormous numbers of plague-bacilli.

The Bronchial Glands showed only a few.

Liver and Kidney, a few ; *Spleen* rather more.

Blood, present, but not in large numbers.

Lymphatic Glands. Right Inguinal showed enormous numbers and so did the left, and generally the larger glands showed more of them than the smaller.

The Right and Left Iliac showed immense numbers.

The Lumbar showed large numbers, but not so many as the above.

The large upper *Cervical* glands on each side showed huge numbers, and the lower glands less.

The large *Axillary* glands of both sides showed large numbers, and the smaller glands a few.

Right Supra-trochlear glands contained immense numbers, and the left extremely few.

Right Popliteal contained a few, and the left scarcely any.

The *Mesenteric* contained very many, presenting almost the appearance of the large inguinal glands.

Thus in this case the plague-bacillus was found in enormous numbers in the pneumonic patches of the lungs, as well as in nearly all the lymphatic glands of the body ; whereas the remaining organs showed it to an inconsiderable extent.

It will be convenient here to give an account of two further cases which were of considerable interest.

F.—CASE OF PLAGUE-SEPTICÆMIA. WITH SECONDARY DEPOSITS IN THE LIVER, AND PNEUMONIA WHICH WAS NOT DUE TO PLAGUE.

S. D., Hindu, female, aged 60, was admitted on 9th March 1897. She was delirious, was in a very weak condition and had some cough ; the inguinal glands were felt to be enlarged, but were not painful ; temperature 102·8. She remained delirious and very ill and died on March 12th. The duration of illness was unknown. *Post-mortem* examination made two hours after death.

Heart.—Some dilatation of right side.

Lungs.—Old thickened pleura with firm adhesions over both lungs, with some engorgement and hæmorrhage in the adhesions. Considerable engorgement and œdema of both lungs generally were present. There was one patch of pneumonia in the early second stage, the size of an egg, behind and below the right apex ; it was irregularly oval in shape, of

a dusky red colour and not distinctly round and marked off from the lung-tissue, as in the cases of plague-pneumonia described above.

The *Liver* was most peculiar ; it was slightly enlarged and congested as in the early nutmeg condition, and was stuffed throughout with small yellow rounded masses in size from pins' heads to peas. They were rather soft and friable but not fluid, and there was no area of engorgement around them. They were found both on the surface and throughout the whole substance of the liver. They looked like necrotic foci.

Spleen, rather large and a little engorged.

Kidneys, senile degenerative changes and a little engorgement.

Intestines, some general engorgement of the stomach and intestines, and distinct petechiæ in the mucous membrane of stomach and large intestine. There were no deposits in any of these organs such as were found in the liver.

Condition of Lymphatic Glands. *Right Inguinal*, the lowest was the largest, like a walnut, light red and firm ; the higher ones were smaller and paler, and one of them contained a small softening area.

Left Inguinal, the lowest was like that on the right side, and the upper ones slightly enlarged and red.

Right and Left Iliac, the lowest was like an almond, light red and rather firm, and the upper ones much smaller and paler.

Lumbar, small and nearly normal.

Bronchial, rather large and engorged.

Supra-trochlear, right, small and normal-looking ; left, slightly large, soft and pink.

Axillary on both sides were all red and engorged, and varied in size from a pea to a hazelnut.

Cervical, like the axillary.

Mesenteric, some looked a little enlarged, soft and pink, and some looked normal.

Distribution of the Plague-Bacillus. Glands, Right Inguinal.—A considerable number of plague-bacilli, which stained well.

Left Inguinal.—Enormous numbers, on both sides ; fewer seen in the smaller glands.

Right Iliac, a fair number, and *Left Iliac* many more ; seen best in the large glands.

The *Axillary* and *Cervical* glands showed a few plague-bacilli ; the *Right Supra-trochlear* very few and the *Left Supra-trochlear* an enormous number, just like the large *Left Inguinal* glands.

Liver.—In the yellow masses described above an enormous number of distinct plague-bacilli were seen, whereas the liver generally showed only a few, about as many as in an ordinary case, and far less than in the yellow patches.

Sections of the liver were also examined, and presented the following appearance:—The liver was in the early nutmeg condition, the central veins dilated, with some blood corpuscles extravasated around them, the portal vessels also congested and fat globules in the adjoining liver-cells. The liver-substance stained badly, and, scattered through it, the above-mentioned masses were seen, all better-stained than the liver-cells and looking finely granular ; some were large, some small, and some were seen under the microscope which were not visible to the naked eye. The small ones were

granular and stained well throughout, but the large were breaking down in parts and irregularly stained. The small ones were distinctly rounded and no liver-tissue was seen in them, but some of the large were less regular in shape and contained some distinct remains of liver-cells: these were probably two or three adjoining masses which had coalesced. Speaking generally, the small masses were mostly situated near the portal spaces, but this could not be said of the larger, as some were as big as two or three lobules. Under higher power the masses were seen to consist of leucocytes, pus-cells, granular debris and remains of liver-cells, and there appeared to be an excess of leucocytes in the surrounding capillaries; in fact, the structure of the masses resembled that of small early abscesses.

Specimens of the liver were also prepared to show the plague-bacilli *in situ* in the sections; enormous numbers of them could be seen in the masses and only a few in the general liver-tissue.

Cultures also were made from the masses, and typical colonies of the plague-bacillus grew in abundance. Thus these small necrotic masses resulted from the growth of the plague-bacillus in innumerable definite areas throughout the whole liver, and are comparable with the pneumonic patches found in cases of plague-pneumonia due to the same cause. This condition of the liver was extremely rare, and was only observed in two other cases during the Bombay epidemic, once by the Austrian and once by the Russian Plague Commission. No similar condition was ever found in the spleen or kidneys to the best of my belief.

Lung.—Cultures made from the pneumonic patch showed the appearance not of plague but of Fraenkel's Pneumococcus; and specimens taken from the patch showed the same pneumococcus under the microscope. Cultures made from the inguinal and axillary glands, from the spleen and from the heart's blood, all showed the typical growth of plague. These cultures were made by Professor Bitter, who has kindly permitted me to make use of his results.

Note.—This was the only case amongst the autopsies on plague made by myself in which secondary pneumonia was found, not due to plague.

G.—CASE OF PLAGUE IN A PREGNANT WOMAN. SURVIVAL OF THE FÆTUS:
DEATH OF THE MOTHER.

D. R., Hindu woman, 25 years old, was admitted to hospital for child-birth on 15th April 1897 at 11 P.M. She stated that she was five days short of her full term of gestation, that for the past several days she had had fever preceded by rigors, and that a few hours before admission she felt some pains in the abdomen of a bearing-down character and thought she was about to be confined.

On admission she was examined and found not to be in labour, and the pains were thought to be false. She was quite conscious and able to walk; temperature 102. She stated that she had two children, and that her previous confinements were normal.

On 16th morning, temperature 102, no pain in abdomen, slight pain and tenderness over right inguinal region, and some glands could be felt a little enlarged. Patient had a peculiar drowsy expression of features, with injection of conjunctivæ, and looked very ill. The temperature remained high and at 4 P.M. was 104. At this hour labour pains commenced. She now complained of some pain in both sides of the neck, and the cervical glands were tender and slightly enlarged; also the pain in the right inguinal glands persisted. At 10 P.M. the patient was very restless; temperature 105; labour was progressing normally. At 10-50 A.M. labour was completed normally. There was no unusual

hæmorrhage; merely the average loss of blood. Patient was much exhausted, temperature 102, pulse 140, respiration 72 per minute, with considerable dyspnœa. The temperature gradually rose to 104, and there was much prostration, dyspnœa, and cardiac failure.

17th, patient died at 7-55 A.M. The child was 18 inches in length and weighed 4 lbs., and although small, it was fully developed. It remained perfectly well, throve, and after 20 days was sent to a foundling home. When last heard of on June 1st, it was still in good health. It never showed the slightest sign of plague or of any illness whatever.

Post-mortem examination of the mother was made three hours after death. Body well nourished, no petechiæ on skin, hæmorrhages under conjunctivæ, *rigor mortis* present.

Heart.—Petechiæ under visceral and parietal pericardium; heart-muscle looked firm; there were *post-mortem* clots in the cavities and in the aorta.

Vena Cava.—Great engorgement of its coats and many hæmorrhages under the inner coat, giving it a mottled appearance; these were seen in the abdominal vena cava as well.

Lungs.—Intense engorgement and œdema; there was one small round patch of early pneumonia at the back of the left lung, it was light red and fairly solid, with recent pleurisy over it. There were small hæmorrhages under both pleuræ. Bronchial mucous membrane much engorged, purple and swollen; the tubes contained frothy watery fluid, but no pus.

Liver.—A little large, its substance rather pale and soft and much engorgement of vessels.

Spleen.—Rather large and soft, of purple colour and engorged; the Malpighian bodies were prominent and appeared to be engorged.

Kidney.—Hæmorrhages under capsule, engorgement of vessels; the kidney substance pale and soft. There were hæmorrhages in the pelvis and calices and the whole ureter was purple red with distinct hæmorrhages under its inner coat. The bladder contained urine, and there were hæmorrhages into its mucous coat.

Uterus.—Large, as of a woman recently delivered. There was much recent clot in its cavity of the normal appearance, and a well-marked corpus luteum in the left ovary. All the generative organs looked normal.

Peritoneum.—Considerable engorgement and large hæmorrhages in the retro-peritoneal tissue, mostly in the lumbar regions.

Brain.—Hæmorrhages under scalp and beneath periosteum on surface of cranium; cerebral membranes engorged, with puncta cruenta in brain distinct; no excess of fluid in ventricles; brain-substance looked normal.

Lymphatic Glands.—*Inguinal*, on both sides, some as large as beans, and some smaller, engorged, light red in colour and œdematous, but some of the upper ones were flatter and more normal-looking.

Iliac right side, the lowest was like an almond, deeply engorged and rather soft, the upper ones were smaller and paler. Left side, lowest like a large bean, and the others smaller.

Lumbar, rather large and a little engorged.

Mesenteric, slightly swollen and engorged.

Bronchial, of normal size, slightly engorged.

Cervical, as large as hazelnuts, deeply engorged and cedematous, and some with a little hæmorrhage into the surrounding connective tissue.

Supra-trochlear, as large as peas and engorged.

Alimentary System.—Tonsils small, slightly engorged, œsophagus rather engorged, but no hæmorrhages in its walls; there were distinct petechiæ in the stomach, a few in the small intestine, and more in the colon and rectum; all these parts being likewise engorged. The sub-maxillary and parotid salivary glands and the pancreas were slightly engorged.

The *Breast* looked normal and contained good secretion of normal-looking milk, and its vessels were rather full of blood.

Under the microscope plague-bacilli in large numbers were seen in the inguinal cervical and axillary glands: they were also present in the blood to a considerable extent.

This account of the pathology of plague is based upon fifty complete autopsies, of which twelve were examples of the pneumonic type. Sections for the microscope of the various lymphatic glands and organs were made in twenty-three of the cases, and from these the minute anatomy has been described. Further, in all the cases, many specimens were prepared to show the distribution of the plague-bacillus in the various parts of the body, and cultures were made as well in nearly every instance. As the results obtained from cultures have not been stated above in the *post-mortem* descriptions, it will be convenient to group them together here. By the method of cultivation the plague-bacillus has been isolated from the following organs and secretions;—from the bubo, and, in septicæmic cases, from plague glands in the various regions (*e.g.*, in one case from the inguinal, iliac, axillary and cervical glands); from the lung, liver, spleen and kidney; from the blood and urine. In one instance the plague-bacillus was proved by Dr. Bitter to be present in the mucus obtained from the large intestine. In cases of plague-pneumonia the bacillus could be isolated from the sputum during life, from the fluid contained in the trachea and bronchi after death, from the pneumonic patches, and in several instances from the bronchial glands.

IV.—MODE OF EXIT OF THE PLAGUE-BACILLUS FROM THE BODY.

From consideration of the *post-mortem* appearances it is seen that engorgement and hæmorrhage are marked features of plague, and further that hæmorrhage is constantly found on the surface of mucous membranes; consequently, as soon as the bacillus has entered the blood of the general circulation, it is possible for it to escape from the body in the hæmorrhages on mucous surfaces. Thus in the urinary system blood may be found in the urine during life, and after death in the tubules and pelvis of the kidney; and, besides, there may be extravasations on the surface of the ureter and bladder; hence by the urine there is a direct route for the bacillus to leave the body.

Again in the alimentary system, petechiæ are nearly always present in the stomach, and as vomiting is a very constant symptom of plague, the bacillus may escape in the vomit; similarly, petechiæ are generally found in the colon and rectum, and hence the bacillus may escape in the fæces. As for the respiratory system, blood may be found in the alveoli of the lungs in ordinary cases of plague, whilst in cases of the pneumonic type it is invariably present; besides, in these latter cases, the bacillus is present in enormous numbers in the pneumonic patches and in the sputum, and it is extremely probable that plague-pneumonia for this reason plays an important part in spreading the disease. (In the preceding section the secretions have been named from which the plague-bacillus was

isolated by the method of cultures.) With regard to the bubo itself, in certain cases it suppurates, and it would seem possible for the bacillus to escape in the pus; but this was not found to be the case, for in several instances where cultures were made from the pus no growth of the plague-bacillus was obtained. It remains to make a remark about the presence of the bacillus in the blood. In a number of *early* plague cases which will be detailed hereafter, cultures were made from the finger-blood, but the bacillus could not be isolated from them, in fact they all remained sterile; whereas in fatal cases the bacillus could always be grown from the blood after death, even when the *post-mortem* was made one hour after death, and in one instance it was grown from the finger-blood twenty-four hours before death. Hence one may say that at least in fatal cases, which form the large majority in this disease, the bacillus is present in the blood for a certain time before death, and is able to leave the body in the various secretions which contain blood.

V.—MODE OF ENTRANCE OF THE PLAGUE-BACILLUS INTO THE BODY.

Having regard to the fact that the initial bubo in plague is usually situated in the glands of the extremities, especially the inguinal and axillary chains, it appears probable that the bacillus may enter the body through a lesion of the skin—preferably of the extremities—and thence travel upwards to the nearest group of lymphatic glands and thus form the bubo. In order to test this theory a large number of plague cases were examined to see if any primary lesion in the skin could be discovered through which the bacillus had entered; and as the patients mostly belonged to the lower classes, who commonly go bare-footed and bare-legged, it was usual to find cracks and abrasions about the feet, and also about the hands, the latter resulting from occupation. Further, as various parasitic skin diseases, such as ringworm and itch, are very common among these people, it will be seen that there are many opportunities for the bacillus to enter the body through the skin.

Bearing in mind the analogy of anthrax and syphilis, the skin was examined to see if any characteristic lesion was similarly present in plague. No such definite lesion was found, but in certain cases the bacillus was proved to be present in a particular lesion on the skin, and as in each instance the bubo was situated in the glands corresponding to the lesion, this place was believed to be the point of entrance of the bacillus. There was nothing characteristic about the lesion. It was usually a small ordinary-looking papule on a slightly inflamed base, with a little serum at its apex and partly covered by a scab. In some cases a hair was found growing through its centre, and it seemed to be merely an inflamed hair-follicle which had been scratched. These cases will now be given in detail.

B., Hindu man, aged 40, came to hospital on 5th October, 1896. Three days ago he was seized with fever, and shortly afterwards found pain and swelling in the left axilla. On admission he looked very ill, temperature 103, and there was a large bubo in the left axilla. On the outer side of the left forearm near the wrist, there was a small papule the size of a pea, with a hair growing through it; it was slightly red at the base, contained a little serum at the apex and was partly covered by a scab. It was not painful, and the patient knew nothing about it; there were no inflamed lymphatics leading from it. Cultivations were made from the serum squeezed from the papule, and a typical growth of plague was obtained. Part of the culture was injected into a rat, and the rat died of plague after 60 hours. On the same date, 5th October, cultures were made from the finger-blood, but all remained sterile. This man died on 8th October.

N. S., *Hindu man*, aged 28, came to hospital December 1st, 1896. There was a large bubo in the vertical set of the right inguinal glands. He said he had been ill three days. There were many old cracks and fissures about the feet and toes, the skin being thick and horny, and some scratch marks on both legs. On the outer surface of the right calf there was a slightly raised œdematous portion of skin about one inch long, and on it there was a small bleb, the size of a large pin's head. From the bleb some thin serum was squeezed out. Cultures were made from the fluid in the bleb and from the finger-blood. A pure growth of the plague-bacillus was ultimately obtained from the bleb, whereas the cultures of the blood remained sterile. In this case, too, the patient could give no history of the œdematous patch on the leg, and there was no pain in it.

N., *Hindu man*, aged 30 years, was admitted on March 3rd, 1897, with a bubo at the back part of the right axilla. He had been ill two days. On the back, near the angle of the right scapula, there was a papule, the size of a pea, on a slightly-reddened base, and partly scabbed over; it looked like a pimple which had been scratched. Cultures were made from the serum squeezed from this papule and from the finger-blood; a pure growth of the plague-bacillus was ultimately obtained from the papule, but the cultures of the finger-blood remained sterile.

P., *Hindu boy*, aged 16, admitted on October 26th, 1896. On either side several of the oblique inguinal glands were enlarged to the size of walnuts, and painful. There was a small unopened papule on the *glans penis* exactly in the dorsal middle line; its apex contained a little pus and serum. It did not look at all like a chancre, and the boy said he knew nothing about it. Cultures were made from the papule and from the finger-blood. From the former a pure growth of plague was ultimately obtained. This was injected into a rat and the rat died of plague. Cultures of the finger-blood remained sterile. This patient recovered.

As confirmatory of the above observations, I may quote as follows from "A Report on the Epidemic of Bubonic Plague at Hong-Kong in the year 1896," by Staff Surgeon Wilm, of the Imperial German Navy:—"As regards infection through the skin, two incontestible cases were observed in the epidemic of 1894. Two Japanese physicians were infected, while making *post-mortem* examinations, and were attacked a few days later by plague. They had axillary buboes and lymphangitis of the arm, which spread upwards from the small inflamed wounds of the fingers.

The above are the four cases in which the plague-bacillus was found in a certain definite situation on the skin, and this place was believed to be the seat of inoculation of the disease; moreover, in each instance, the corresponding proximal glands formed the bubo, and there was nothing characteristic about the skin lesion. It looked like an ordinary pimple which had been rubbed or scratched, and no local reaction had occurred in it, due to the presence of the bacillus; also, it was not painful, and the patient was unaware of its existence. It may be stated here, that in a large number of other patients, small papules or abrasions were similarly examined, but the plague-bacillus was not proved to be present. Thus, in one instance a man had acne extensively on the face and a bubo in the left cervical region; in another, three small scabbed wounds on the right foot with a bubo in the vertical right inguinal glands; in a third, a number of papules on the left arm with a left axillary bubo, and other cases could be quoted. Some of the papules were examined in these cases, but with a negative result. A point remains to be noticed; it may be objected, that if the bacillus were already in the blood, it could pass with the serum into a papule wherever situated, and

its presence there would be the result, and not the cause, of the disease. But against this view there are the facts, 1st, that in the above four cases, which were all early, the bacillus could not be isolated from the blood on the same day that it was found in the papule; and, 2nd, that in a number of other early cases, pimples situated in various parts of the body were examined, not only on the limb corresponding to the bubo, but the bacillus was not found in them. Also in three early cases of inguinal bubo, a small blister was raised upon the chest, but the plague-bacillus could not be isolated from the contained serum.

The conclusion drawn is, that the bacillus of plague can enter the body through a trifling lesion in the skin, that it produces no local reaction at the seat of inoculation, and that the bubo is formed at the nearest proximal glands.

With regard to infection by food, no evidence was found *post-mortem* that the bacillus had entered through the stomach or intestines; but cases of cervical bubo might have resulted from infection through abrasions on the lips, tongue or tonsils.

As for the cases of primary plague-pneumonia, no evidence of the path of infection was found, but the bacillus was thought to have entered by the respiratory tract, as its growth had mainly occurred in the lungs.

APPENDIX A (to Capt. Childe's Report).

On the Clinical Aspect of Plague-Pneumonia.

When plague appeared in Bombay, and as the disease developed, one was struck by the following facts:—First, in all published accounts of the disease, although the ordinary phase of the malady, *viz.*, plague with buboes, is principally described, still mention is always made of another and more fatal form without buboes; whereas, here in Bombay it seemed as if the bubonic form were alone appearing, for, at the beginning, one saw no examples of the other form. Then one observed that coincidently with the increased death-rate due to plague, there was a large and unexplained increase assigned to remittent fever and respiratory diseases. Week by week, as the plague mortality increased, so did that under these two headings, and though it was possible that all these were cases of known but concealed plague, still one could not help suspecting that some of them might be due to plague which was not diagnosed because of the absence of buboes. So I resolved to examine the bodies of all hospital patients who had died of fever, pneumonia or any acute illness, to see if there were evidence that any of them had really died of plague. And at the end of December I met with a case which had been diagnosed as broncho-pneumonia, but which turned out to be one of plague affecting the lungs, without causing any marked enlargement of the lymphatic glands—a case, in fact, of plague-pneumonia; and its *post-mortem* was exactly like many others that I have since made, typical of the disease, and I will give a few notes of it.

B. L., *Hindu, male*, 25 years old, admitted for fever and cough, December 26th, 1896, under Dr. S. He said he had been ill for about seven days. He had symptoms in the chest which led to the diagnosis of broncho-pneumonia being made. No lymphatic glands were found to be enlarged or painful, and a specimen of blood taken by Dr. S. shewed no plague-bacilli under the microscope. He coughed up about two ounces of blood-stained fluid on the night of the 27th, and died at 3 A.M. on December 28th.

Post-mortem on December 28th, seven hours after death.

Lungs.—Much general engorgement and œdema, with sero-sanguineous frothy fluid in the bronchi, but no pus; and the usual appearances of acute bronchitis were absent. There was one small pneumonic patch, the size of a walnut, in the early second stage, situated a little below the apex on the front of the right lung, and two similar but smaller patches at about the same part of the left lung. These patches stood out a little from the surface and were light grey in colour, airless, friable and sank in water; and each was surrounded by a dark ring of engorged lung in the first stage of pneumonia, which merged into healthy lung; there was some recent pleurisy over the pneumonic areas. All the other organs were examined and showed considerable engorgement, but no special lesion was observed.

Condition of the Lymphatic Glands.—The bronchial were quite small and of normal appearance; the cervical were slightly enlarged, but pale and not engorged; the axillary were pink and slightly enlarged; the left iliac were somewhat large, red and soft; the lumbar were swollen but pale; and all the other glands looked absolutely normal.

Cultures were made on agar-agar from the pneumonic lung and spleen, and ultimately a pure growth of the plague-bacillus was obtained from each.

Microscope.—The pneumonic patches in both stages showed an immense number of plague-bacilli, and the rest of the lung showed a large number; the left supra-trochlear and the left femoral glands shewed a fair number, and all the other glands extremely few; the spleen and blood also showed a few.

So this was a case of plague, in which during life all the symptoms pointed to disease of the lungs, and in which there were no evidences of glandular enlargement, whilst after death there was clear proof of enormous growth of plague-bacilli in the lungs, and of only very slight growth in the lymphatic glands.

I have made up to the present twelve *post-mortems* on such cases, all presenting appearances similar to the above, and I may add, that all the patients were brought to hospital by their friends, supposed to be suffering from cough and fever, and, as far as I know, they were quite unaware of the nature of the disease. I have also to say that in nearly all the other cases the fluid from the trachea or bronchial tubes has also been examined; it shows an immense number of plague-bacilli, and cultures of plague can always be obtained from it.

With regard to the clinical symptoms of these cases, it fell to me to attend on the late Dr. Manser, and as he died of this form of plague, I will mention a few facts about his case. He was in his usual health on January 2nd, and had a sudden rigor in the morning and felt fever coming on. During the day a bad headache developed, he felt nausea and vomited several times, and he had pains and a tired feeling in his limbs; his tongue remained clean and moist, and his skin was slightly moist. At 2 p.m., temperature 103·4, pulse 116, respiration 25, and there were but slight variations during the day. On January 3rd, had passed a bad night and felt worse, and all the symptoms persisted, except the aching in the limbs, and he felt very ill. The temperature remained between 103·5 and 104·5, pulse about 110, and respirations about 23 throughout the day. During the afternoon he felt some pain at the lower part of the left axilla, just under the anterior fold, but there was no glandular enlargement or pain in the glands anywhere. On January 4th, had passed a bad night and felt very ill, temperature 104·6, pulse 113, respiration 25, tongue still moist, with a little fur behind, and no sordes about the lips or teeth; the other symptoms as before. During the night he began to cough and brought up some watery sero-mucous fluid, slightly blood-tinged, and the pain remained in the same place, only more diffused now, being felt over an area of a square inch. At this part some moist sounds could be heard like those of early pneumonia, and they could also be heard just below the left clavicle; the rest of the lungs and other organs appeared to be normal, as did the lymphatic glands. Patient considered that he had pneumonia, but the symptoms were not like ordinary pneumonia. For the onset was different, the condition of the tongue and mouth different, there was no dyspnoea or pneumonic disproportion of pulse and respiration, and the sputum was not at all like rusty sputum; for it was loose and free, coming up with the slightest cough, it was watery, looking more like serum than mucus, and it was slightly pink, not rusty yellow at all. Also there was the striking fact that the patient's general condition was far worse than could be explained by the small amount of lung-disease present. So I examined the sputum under the microscope, and found it full of bacilli looking like those of plague, and cultures were made from which a pure growth of the plague-bacillus was obtained. During 4th and 5th, patient became steadily worse, his temperature remained about 104, and his expectoration became most profuse; the moist sounds were heard over a larger area, as well as slightly at the bases; the respirations increased to 35, and then to 45, and the pulse to 120 and 135; and he ultimately died early on January 6th.

There is also the case of the nurse who attended him, who unfortunately died of a similar form of plague. In brief, she became ill on the evening of January 7th, and showed

symptoms of pneumonia on January 8th. She rapidly became worse and died on the 10th, but her sputum was not nearly so profuse as in the former case, and symptoms of exhaustion came on much earlier. She also had no glandular pain or enlargement whatever, and bacteriologically her sputum was exactly as described above. Other cases were met with, in which, besides plague-pneumonia, there was also general enlargement of the glands,—plague-septicæmia; and clinically it was found that either the pneumonia was primary, and the glandular enlargement secondary, or that the disease first shewed itself in the glands and later on in the lungs; and whilst some of the latter recovered, the former were usually rapidly fatal. Also the sputum was not always as has been described above, for in some cases the presence of blood in it was a marked feature, and it was either moderate or abundant in quantity. These pneumonic forms of plague are highly infectious, and probably take a large share in the spread of the disease; for in these cases the patient's sputum is practically a virulent pure culture of the plague-bacillus, and as there is reason to believe that many of the cases are not recognised as plague at all, precautions are not taken by the patients' friends, and the dangerous nature of the disease is not appreciated. I have no means of knowing how frequent this variety of plague has been in the present epidemic, but there is some evidence to show that a considerable number of cases have occurred. Moreover, it seems likely that a ship's passenger suffering from this form of plague might escape detection by sanitary officers, and might be permitted to land at his destination as though he were the subject of simple pneumonia; and so a centre of infection for the spread of plague would be established. With regard to the literature on this subject, I have not been able to find a published description of this variety of plague;* but an allusion to it is made in the accounts of the Pali epidemic of 1836, and it is stated that the Astrakhan outbreak of 1877 was first regarded as croupous pneumonia or as typhus complicated by pneumonia; from the reports on the Hongkong epidemic it appears that plague-pneumonia did not occur there. There is just this to add: the usual definition of plague in works on medicine is—"A specific fever attended by bubo of the inguinal or other glands," but it is clear that such a form of words does not include all varieties of the disease. (This paper was read before a meeting of the Bombay Medical and Physical Society on April 2nd, 1897.)

[Appendices B and C to Dr. Chible's Report are omitted. They deal with involution forms of the bacillus in the human body, and with a carbuncular case of plague.—J. K. C.]

SUMMARY OF WORK CARRIED ON BY MR. HANKIN.

Mr. Hankin has carried out a long series of researches on the action of disinfectants on the microbe of bubonic plague. He finds that it is somewhat resistant to the action of carbolic acid. Both phenyle, lysol, and izal appear to have a more energetic action. Phenyle and lysol, however, were found not to exert a marked bactericidal action on a cow-dung floor. Naphthaline was found to have no action on the plague-microbe. The plague-microbe was found to be comparatively resistant to the action of alkalis, and especially sensitive to the action of acids. Even weak organic acids appear to destroy it readily. It is, however, usually able to exist for some hours in acid urine. Milk, so soon as it has acquired an acid reaction, appears to have acquired the power of destroying the microbe. Inorganic acids are naturally still more active, and Mr. Hankin thinks that sulphuric acid might be used as a cheap disinfectant against the plague infection. The microbe was found to be resistant to the action of reducing agents, and sensitive to the action of oxidising agents, such as permanganate of potash or chloride of lime. A solution of one part of permanganate of potash in 50,000 parts of water appears to be capable of destroying

* *Vide* p. 5, where an account by Dr. White is given.—J. K. C.

the plague-microbe in five minutes under the conditions of Mr. Hankin's experiments, but this substance is not recommended as a disinfectant except in cases in which there may be reason for thinking that water has been infected by the washing of infected clothes, etc. It was shown that the activity of potassium permanganate in destroying microbes may be greatly increased by the addition of a small quantity of sulphuric acid, but the mixture is not recommended except under special conditions. Mr. Hankin discusses the bearing of his observation of the sensitiveness of the microbe to oxidising agents on the generally advocated plan of combating the infection by means of ventilation, which, he shows, is probably a means of producing oxidation under the influence of air and light. A series of observations was made in houses undergoing disinfection. Results were obtained throwing doubt on the utility of sulphur fumigation and whitewashing as a means of destroying the microbe. Mr. Hankin comes to the conclusion that the only substance capable of satisfactorily disinfecting a cowdung floor is sublimate in an acid solution. Sublimate in a neutral solution was found to be without action on the microbes present. As an after-treatment and as a means of treating court-yards, passages, and drains, Mr. Hankin recommends sulphuric acid in a strength of 1 in 250, which solution he shows to be far cheaper than that of other disinfectants in common use. It is likely that this will make the treated places for some time unfitted to act as a nidus for the microbe, for the latter is shown to be destroyed within 5 minutes by a solution of the strength of 1 in 1429. Another method of disinfecting floors investigated by Mr. Hankin is by covering them with a layer of combustible material at least two inches thick, which is then set on fire. It was shown that this treatment is far more efficacious than the use of ordinary disinfectants. Though it is pointed out the risk of fire may prevent the wide application of the method in towns, it may find application in the treatment of public latrines that may be supposed to be infected, and which are commonly built of incombustible materials.

Mr. Hankin has also carried out a series of experiments on the asserted possibility of finding the bubonic microbe in the earth of infected houses. He has examined large numbers of specimens brought from places in which many people had recently succumbed to the infection without finding the microbe in any case, with one probable exception. The search has been carried out by several methods, including one communicated to him by Professor Calmette, which method appears to have been the one employed by Yersin in Hongkong, and which led him to positive results. In Mr. Hankin's hands no such results were obtained, thus throwing doubt on the statement that the microbe can be readily found in the soil of infected houses, at any rate by existing methods.

The only case in which a microbe probably identical with that of plague was met with was in some salt-water in a field near Siwri, at the time that the epidemic was present in the place. Some of this water was injected into a mouse. On its death a microbe was isolated from its organs, which resembled that of plague in most respects, but which differed from it in the rapidity with which it formed involution forms on agar-agar. Mr. Hankin found that the plague-microbe could be changed into a microbe having these aberrant characters by cultivation on agar-agar containing three or four per cent. of salt, and that further the microbe from Siwri was pathogenic to a rabbit that had not been protected by Haffkine's plague vaccine, but had no effect on a rabbit that had been so protected. Consequently it was supposed that this microbe was the plague-microbe altered by its sojourn in salt-water. This observation had led to the discovery of a rapid method of identifying the plague-microbe by its cultivation on agar-agar containing a certain percentage of salts. It has been further worked out by Surgeon-Captains James and Thomson under Mr. Hankin's supervision.

Mr. Hankin has investigated the relation of insects to the dissemination of the disease. He has found the microbe in bugs from the Infectious Diseases Hospital. He has also found it in ants that had recently been eating rats dead of plague. A long series of experiments showed that ants do not retain the plague infection long, and further that no trace of infection is present in ants from localities in which rats have not been dying recently. Hence these insects cannot be regarded as important agents for the spread of the disease.

Experiments were carried out on different kinds of grain and other articles of export. They were infected with plague-microbes under many different conditions. At stated intervals extracts of specimens of the infected grain were prepared and injected into mice. By this means it was found that the infection usually died out within 4 to 6 days. The possibility was indicated that it might in exceptional cases survive for so long as 13 days, but of this no definite proof was obtained. Mr. Hankin points out that grain, when it becomes rotten, usually acquires a well-marked acid reaction owing to the production of various fatty acids from the decomposition of carbohydrates. He has found that such fatty acids act as disinfectants for the bubonic microbe. Hence it is difficult to believe that the microbe can exist in rotten grain, as has been frequently assumed. The matter was put to an experimental test by Dr. Srinivasa Rao while working in Mr. Hankin's laboratory. It was found that the microbe always dies out in rotten grain within 2 to 24 hours.

The microbe, though usually dying out, when placed in sterilised water, within three days, appears to be able to survive in sterilised cowdung for several days. The observation appears to have some bearing on the question of the persistence of the infection in houses having cowdung and mud floors. Through lack of time these experiments could not be continued sufficiently for any conclusion to be arrived at as to whether any particular kind of filth is more suitable than another to sustain the life of the microbe. *But the general trend of Mr. Hankin's observations is to indicate that the chief source of infection is not likely to be in a saprophytic form of the microbe in the outside world, but more probably in the recently passed excreta of men or animals suffering from the disease.*

[Special emphasis has been laid on the last sentence of Dr. Childe's Report, in order to draw attention to a conjecture, which, though founded on slender evidence, appears nevertheless to belong to that order of conjectures which ultimately prove of the highest importance.—J. K. C.]



PLATE 1.

Plate 1.

THE STAFF OF THE IMPERIAL RESEARCH LABORATORY, OCTOBER 1899.

Front Row, Media makers.	Second Row, superior staff.	Third Row, clerks and decenterers.	Back Rows, attendants and servants.
Asst. Surgeon Kantak, Rao Bahadur ;	Dr. Marsh ;	Major Bannerman, I. M. S. ;	Dr. Starkey ; Asst. Surgeon Gordoiro.
Dr. Hanna.	Capt. Milne, I. M. S.	Dr. Maitland Gibson.	Asst. Surgeon Kapadia.

CHAPTER III.

Part I.—The Rise of the Plague Research Laboratory.

The results obtained by Mr. Haffkine in Calcutta with his anti-cholera inoculations—on which he had been engaged in India since 1893—had been so encouraging that the Government of India sent him to Bombay when plague broke out there to endeavour to discover some similar method of dealing with that disease. He reached Bombay on the 7th of October 1896, soon after the existence of plague had been publicly recognised, and on the 8th October began work in the Petit Laboratory at the Grant Medical College. His laboratory consisted of one room and a corridor, and his staff of one clerk and three peons. None of these persons knew anything of bacteriological methods, and had therefore to be trained by Mr. Haffkine personally. In this laboratory Mr. Haffkine worked for three months before he could be sure that he had found a means of diagnosing the plague-microbe with unfailing certainty. This he discovered in a distinguishing and characteristic pendent growth having the form of stalactites assumed by the microbes when they are cultivated in a suitable fluid medium, and allowed to hang together in chains composed of numerous individuals. From pure cultivations of the plague microbe, grown in nutrient bouillon, as above, Mr. Haffkine obtained a fluid with which he was able to work out a preventive inoculation to check the susceptibility of man and of animals to the disease produced by the plague-germ. The first demonstration of the value of this fluid as a means of prophylaxis to plague was made on rabbits in the laboratory. It was found that rabbits artificially infected with virulent plague-microbes died of plague, whereas rabbits which had been previously inoculated with this protective fluid resisted the virulent microbes, so that they were unable to produce the disease. These observations, made in December 1896, encouraged the trial of the fluid on human beings. On the 10th January 1897 Mr. Haffkine underwent inoculation with this same fluid (Dr. Surveyor, who had by that time joined him in the laboratory, operating), and proved on his own person the harmlessness of the vaccine. In the last week of the same month the historic outbreak of plague in the Byculla House of Correction in Bombay took place, which afforded the first opportunity of testing the immunising properties of the vaccine. Here was a population of 321 adult prisoners living under identical conditions of life, exposed to the same chances of infection. Of these 148 submitted to inoculation. The subsequent incidence of plague in this population was as follows—

		Cases.	Deaths.
172	Uninoculated persons	12	6
147	Inoculated persons	2	0

This result served as an inducement to many persons in Bombay, and the room in the laboratory became crowded with applicants for inoculation.

Dr. Surveyor's health having broken down in February 1897, his place in the laboratory was taken by Dr. Kalapesi, and help in other ways was given by numerous volunteers among whom the Professors of the Grant Medical College may be specially mentioned.

Shortly after Mr. Haffkine came to Bombay on this special work, a Plague Research Committee, consisting of—

Major Manser, I. M. S. President,
Captain L. F. Childe, I. M. S.,	} Members,
W. M. Haffkine, Esq., C. I. E.,	
E. H. Hankin, Esq.,	
Dr. Surveyor,	

was appointed by Government in October 1898. The objects of this Committee covered a very wide range and were roughly distributed as follows :—Major Manser,—whose unfortunate death from pneumonic-plague in February 1897 necessitated his place being filled by Major Lyons, I. M. S.—clinical aspects of the disease; Captain Childe, pathology of plague; Mr. Haffkine, the study of the microbe and its relation to man and animals, prophylaxis, etc.; Mr. Hankin, value of disinfectants and mode of dissemination in Nature; Dr. Surveyor, plague in animals.

It is both fitting and interesting to record here that Dr. Manser's case afforded the first demonstration of the plague-bacillus in the sputum of the victims of the pneumonic form of plague (a form previously described by Dr. White in 1815 in a little known report *); a pure culture of the plague-bacillus being recovered from his handkerchief by Mr. Haffkine; to whom it was sent for examination by Captain Childe, who was now the first to suspect this new development of the disease. Suspicions of the infectious nature of this type of plague were now first aroused by the death, from this very type of the disease, of Miss Joyce, the lady nurse who attended Major Manser in his last illness. Full details of Dr. Manser's case are given in Chapter II., p. 108.

For the next year and more, therefore, Haffkine's Laboratory, such as it was, although its staff and a portion of Mr. Haffkine's salary were defrayed by the Municipality, was but a branch of this Committee.

The first improvement in the accommodation of the Laboratory was made on the 1st April 1897, when a house on Malabar Hill—"The Cliff"—was rented and fitted up by the Municipality and placed at Mr. Haffkine's disposal. The different rooms in this bungalow were utilized for the various stages in the manufacture of the prophylactic, also for the storage of the vaccine in flasks and bottles. At this stage Major Bannerman, I. M. S., who had been deputed by the Government of Madras to study under Mr. Haffkine, became associated with him, and they, with two civilian doctors, had the assistance of a staff of two clerks, three peons, and four *hamals* in the work of the laboratory. The Cliff bungalow was in use till November 1897, when, it being required for other purposes, a move was made to another house in Nepean Sea Road, also provided by the Municipality.

At this time H. H. Aga Khan, head of the Khoja community, who had all along taken great interest in inoculation, and had, indeed, opened a station for the benefit of this community in one of his houses in Love Lane, Bombay, offered to place at Mr. Haffkine's disposal the large house called Khushru Lodge in Nesbit Lane, Mazagaon. This house was fitted up with gas and water, and otherwise rendered suitable for a laboratory, at His Highness' expense: and for a year from February 1898, Khushru Lodge fulfilled its function admirably. The staff under Mr. Haffkine at this time (February 1898) consisted of one Commissioned Officer, I. M. S., four special Plague Medical Officers sent out by the Secretary of State for India, four local medical men, three clerks, three peons, and six *hamals*. With the help afforded by this extension of his staff, Mr. Haffkine was able to co-ordinate the services of his assistants into an effective machinery of research for the investigation of improvement connected with the manufacture of the prophylactic, and for information on questions relating to the phenomena of plague generally.

From March 1899, however, the demand for the prophylactic vaccine from all parts of the world increased to such an extent that it became necessary once more to enlarge the Laboratory: and from the 4th of March 1899 all charges in connection with the Laboratory

* *Vide* Introduction, p. x.



Plate 2.

Mr. W. Haffkine in his Laboratory, at Khushra Lodge.



Plate 3.

The Staff of the Laboratory at Khushra Lodge, about July 1898.

Dr. Marsh, Mr. Haffkine, and Capt. Milne.



Plate 4.

Mr. Haffkine, Captain Milne, and Assistants inoculating in the streets of Bombay.





PLATE 5.

Plate 5.

MEDIA PREPARATION ROOM.

At the left hand side of the picture, the operation of mincing the goat's flesh is seen.
 The attendants at the centre table are filtering and measuring the bouillon.
 The attendant at the extreme right, is testing the reaction of the bouillon with litmus paper.
 Behind him are seen two autoclaves (boilers) used for digesting the goat's flesh.

were accepted by the Government of India *: the Laboratory itself thus becoming an Imperial concern. Fortunately, a sufficiently large place was available in the old Government House at Parel, and hither the Laboratory has been finally moved, and here it will have room to expand as circumstances may demand.

The new Laboratory at Government House, Parel, was formally opened by H. E. the Governor, Lord Sandhurst, on the 10th and 26th of August 1899, in the presence of a large and representative gathering of Europeans and natives. The following accounts of these functions are taken from the *Times of India* :—

“ The new Plague Laboratory at Parel was yesterday (10th August 1899) evening formally opened by His Excellency the Governor of Bombay. There were a large number of the principal European residents present, and many influential natives were also in attendance. The entire premises had been most carefully prepared for the occasion, so that visitors would be able to see the whole process of the manufacture of plague prophylactic. Besides this, there were several microscopes through which might be seen various forms of bacteria, and excellent plates made clearer, in certain instances, the life history of disease-germs. At every point were those capable and willing to explain, and few could have left the building without being wiser in some particular than when they entered. His Excellency appeared to take the deepest interest in all he saw and heard, and great credit is due to the officers of the Laboratory for the excellent arrangements which had been made. These officers, it may be mentioned, are:—Major Bannerman, Captain Milne, Dr. Marsh, Dr. Maitland Gibson, Dr. Hanna, Dr. Starkey, Dr. Paymaster, Dr. Kapadia, and Dr. Cordeiro.

“ After the tour of inspection had been completed, all returned to the porch, where, at the request of His Excellency, Major Bannerman gave a brief account of the prophylactic and its action. His speech was as follows:—

“ Your Excellency, Mr. Woodburn, Ladies and Gentlemen—‘ It is an unexpected pleasure that has fallen to my lot, as I was not aware that I should be called upon to explain the manufacture of the prophylactic, which you have just had demonstrated to you. I will try, however, to explain in as few words as possible this somewhat technical subject. The first thing to do is to find a suitable medium or soil on which to grow the plague-germ. The process of preparation you have all seen and had demonstrated to you by Captain Milne. Nothing has been hidden from you, for there is nothing requiring concealment, you have seen the goat’s flesh minced up, mixed with acid, digested by heat, filtered, neutralised and finally sterilised in the large steriliser. We have now got our soil ready for sowing, so the seed must be procured. This is got, as you all know, from the bubo of a plague-patient. Now, in agriculture two things are required to produce a good crop, viz., a good soil and good seed. Similarly, our seed must be pure and unmixed with the seeds of any other disease, for we wish to have a pure growth. For this purpose we first sow our plague-seed in a tube full of jelly, on the surface of which it is spread out. I trust you have all noticed those tubes of jelly as you passed through the rooms. Two days after it is sown we can tell by looking at the surface of the jelly, whether the growth now visible is pure plague or not, just as any of you can tell the difference between the buttercups and daisies growing in your gardens, or as you can pick out your friends in a crowd by ‘ head mark ’ as it were. To make assurance doubly sure, however, we take a few of these plague-bacilli from the jelly tube, and sow them in a small flask of clear broth and watch to see whether these long silky stalactites are formed, which, I am sure, you must all have admired in the dark room inside. This appearance is an absolutely certain sign that we are dealing with the plague-germ, for no other known germ produces similar stalactites. This important discovery made by Haffkine, renders it possible for us to make an anti-plague vaccine, and to save thousands of lives which would otherwise be lost. When we are thus quite certain, then, that we are dealing with the plague-germ alone, and have no other germs in our flask, we transfer its contents to the long-nosed Pasteur flask, which you saw Dr. Maitland Gibson working with. By means of this ingenious contrivance we can sow any number of large fermentation flasks. These large flasks are then placed on tables in the dark room, and allowed to ferment for six weeks, when the prophylactic is ready for use, after the live germs in the flasks have been killed by heat. During this period of fermentation the bacilli have been excreting inanimate poison into the broth. In the small bottles then that we send out there are two things, viz., (1) dead plague-bacilli; (2) lifeless poisons excreted into the broth by these bacilli before they were killed. This mixture is what is injected under your skin when you are inoculated, and I must now explain how protection from plague can be thus secured. It has been proved that all diseases such as plague, cholera, typhoid fever, etc., are caused by living germs, each disease having a germ or seed of its own. Just as in

* Government of India’s letter in the Home Department, Medical, No. 374 of 4th March 1899.

agriculture when you sow wheat, you will get a crop of wheat, and not one of barley, so when plague-seed is sown in a man's body plague symptoms appear and not those of any other disease. The symptoms are caused, not by the bacilli themselves, but by the poisons excreted by them into the body of the victim. If the person attacked should recover, he has the comfortable consciousness that he will not, in all probability, suffer again from the same disease. This happy result is produced by the action on the body of the bacterial poisons. Why then should we not produce this poison outside the body by growing the bacilli in flasks, and then collect the poison they have secreted there? This is actually what we do in the laboratory here as you have seen for yourselves to-day. From these bottles we can take a measured quantity of dead germs, and their poisons, or toxins, as scientific people call them, and inject them into your bodies. The body then reacts in the same way to the poison produced in bottles, as it would to the same poison had it unfortunately been manufactured in itself instead of in the flask. *The result is that the injected person does not get plague.* If we return to our agricultural simile once more, we may get some light on the matter. You all know that if a soil is heavily salted it will no longer produce crops; so in the same way we may say that a person who has passed through an attack of plague has become "salted," for the plague germ can no longer grow in the soil of his body. The same effect is produced by inoculation, with the difference, that there is no danger of dying during the process, and that the inoculated person is in no way dangerous to those around him. The plague-germ, when it gains entrance to the body of such a person, finds a "salted" soil, and cannot grow and multiply, and if it cannot grow it cannot produce any toxins, and so no effect on the individuals is produced. I trust I have been able to throw some light on this somewhat technical subject, and that you will all now be able to preach inoculation in your own neighbourhoods.'

"His Excellency, who was cordially received, then addressed the company. He said:— 'I have little doubt that you all now thoroughly understand the process by which this prophylactic is made. For certainly, as regards myself, without the explanation given here and in the lecture rooms, my interest would have been more sympathetic than intelligent. But enough has been said by Major Bannerman to show all interested—and it appears to me that everybody in India at this moment is interested—in inoculation that there is nothing to hide in the preparatory process. Nothing can exceed the caution and care with which every stage in the manufacture is accomplished so that it may be of the purest possible nature. Parel has seen various vicissitudes. Many, many years ago it was a Jesuitical Seminary, I believe, and many years afterwards it became the Governor's residence. Three or four years ago I handed it over for a plague hospital, and I really think under General Gatacre's management it was the most popular plague hospital. Now it has been lent by the City Improvement Trust to be the home of this laboratory. It is difficult to say how much successful research may be accomplished or what benefits may not accrue to the studies that will be carried on here. I have frequently had to make speeches about plague measures before, but never have I spoken on this particular subject. As I said at the commencement of my speech, it would be merely a waste of time for me to express an opinion upon inoculation or prophylactics, except this, and I think I am justified in saying it, although a non-expert I have been asked at various times and places whether I would recommend inoculation. We all know there is no forcing of inoculation, and, therefore, comes the question as to recommending. I have seen various reports which have come from Dharwar, Hubli, and other places, and, although non-experts, we are entitled to read these reports and form our own conclusion. My conclusion, after reading these reports, and after consulting many medical men and others who have watched the results of inoculation, is that if I myself were in the position of many a doctor and many a nurse who from morning to night are engaged in plague duty, I would be most certainly inoculated. (Applause.) More than that, if I were asked to advise as to certain individuals in a particular class liable to attacks of plague I should most certainly say "Be inoculated." (Hear, hear, and applause.) Well, Major Bannerman, you will agree with me that this is a doctor's afternoon, and I do not, therefore, propose to occupy your time much longer. What I would wish to say, however, is how much I am conscious of the heroic manner in which the members of the medical profession have worked for the last three years in endeavouring to stem the tide of the epidemic. We have, too, employed on plague work officers from the Army, the Forest Department, the Revenue and the Salt Departments, and while all have worked splendidly, it has generally been considered that after all the doctors were the men. My experience of them has been that whether going their rounds in the up-country villages, whether watching cases in the hospitals, or going deep into the great bacteriological problems which present themselves, their conduct in this Presidency has been beyond all praise. (Applause.) Now I have to perform an easy task, the task for which I came here, and that is to formally declare this institution open. Like most places of the kind so opened, I am glad to think it has been doing useful work for some considerable time, and Major Bannerman is, you will all agree, to



PLATE 6.

Plate 6.
MEDIA PREPARATION ROOM.

Autoclaves for digesting the goat's flesh seen on either side of the room. Meat-mincing in front of closed door. The snail tub contains Louillon being neutralised ; Lieut. Milne is examining a strip of litmus paper to see when this is properly accomplished.

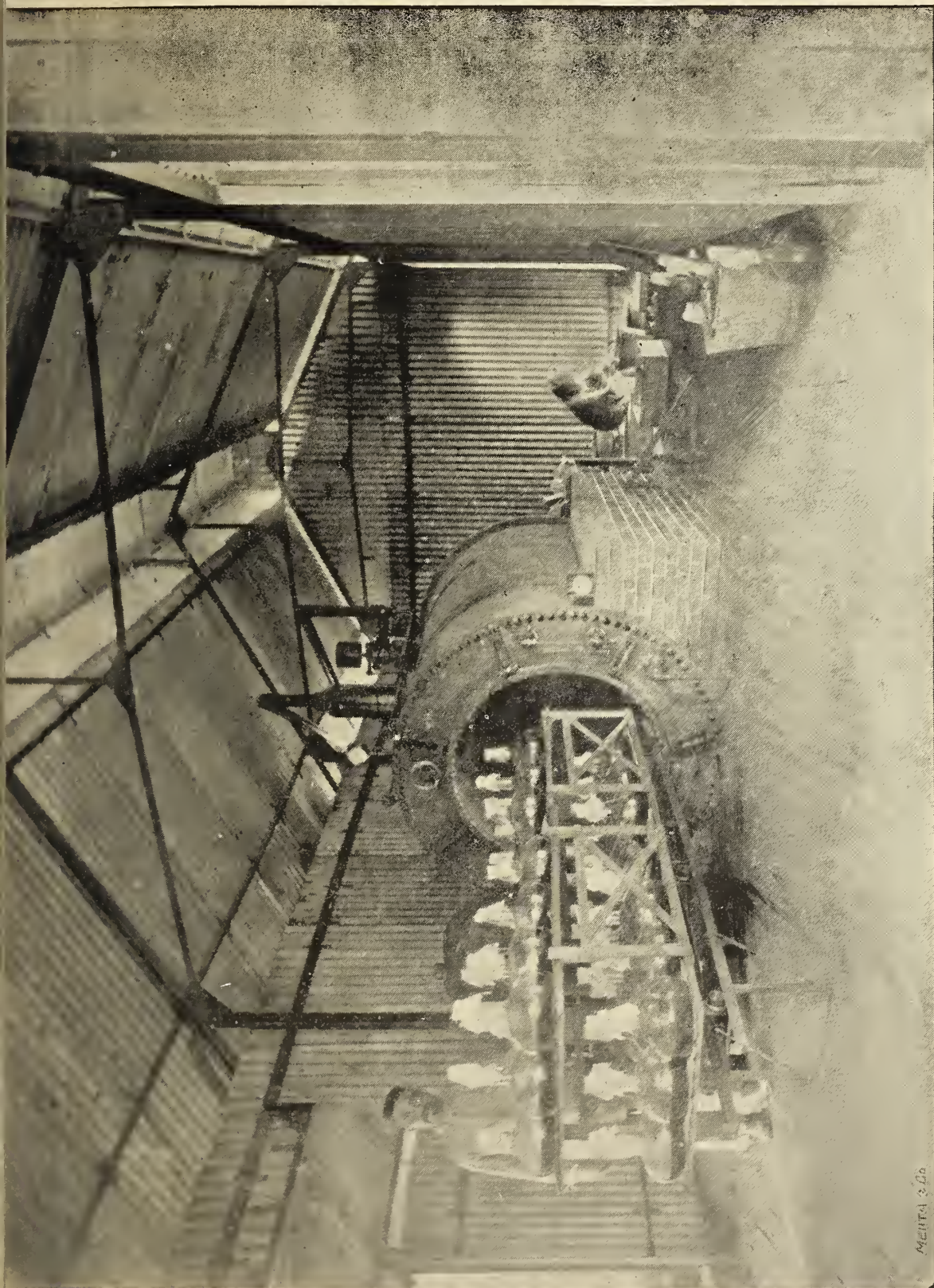


PLATE 7.

Plate 7.

Steriliser, in which the 4-litre flasks of bouillon are sterilised under a steam pressure of lbs. 15 per square inch. Fifty or 60 flasks can be treated at one time.

be most heartily congratulated on the extremely efficient staff he has under his command. He is also to be congratulated upon the laboratory which, I believe, he himself considers to be in every point satisfactory. The Government of India have done well in establishing this laboratory, and I have little doubt that there will be others set up in various parts of the country. Once more wishing you well in the task before you, Major Bannerman, and knowing that your reputation must be increased as your scientific wares are sent all over the world, I have great pleasure in declaring this institution open, and give it my best wishes." (Applause.)

"The proceedings concluded in the usual manner."

His Excellency's second visit to the Laboratory is thus described in the same paper:—

"On Saturday evening (26th August 1899) His Excellency the Governor of Bombay inspected the new Laboratory at Parel, and was accompanied by a large number of guests who had been invited for the occasion.

"Major Bannerman delivered an interesting address on the effect of the prophylactic, in the course of which he pointed out that people were inoculated with the dead bacillus, and were, therefore, absolutely non-infectious. He had, he said, just received some startling figures from Belgaum.†

* * * *

"His Excellency said: 'I do not propose to make any speech on this occasion, but I think I may express the thanks of the meeting to Major Bannerman for the extremely clear and interesting lecture he has given us on this important subject. I myself have had to do with hospitals, intimately I might say—for certainly the last ten or fifteen years, and while I have been very familiar with many medical men and the administrations of a great many—almost all—of the larger hospitals in London, there is one position I never expected to find myself in, and that is the position of a medical student. But here we are all medical students, and I am sure that in the same category I may include my friend the Bishop of Bombay, and the Roman Catholic Bishop equally so. We are all, I am sure, glad to sit at the feet of so distinguished a lecturer as Major Bannerman. Well, now, Major Bannerman made a very fitting reference to the genius of Prof. Haffkine. Major Bannerman tells me he is now making use of the genius of that distinguished scientist, and that the discovery of Mr. Haffkine has unquestionably, as all the world now knows, been instrumental in saving an immense number of our fellow-subjects in India from death. I may say further that the wares, as I may call them, from the laboratory at Parel will, no doubt, in a very short time, find their way into Southern Europe and into England, and when the time comes for the history of this plague to be really written, it cannot be doubted that the name, from the point of view of science, of Professor Haffkine will occupy the foremost place. (Applause.) I am very glad to see such a representative and varied gathering as that which is sitting before and standing around me. I see a very large number of faces in the rows beyond there which are well-known to me in my visits round the city, and in my connection with what we know as plague volunteers. It is not too much, I think, to ask that they should lay to their hearts what they have heard in explanation of the process of inoculation and the preparation of the prophylactic, and advise according to experience and their observation. Some startling figures have been read to us from Belgaum. I can give you my own personal experience as regards the efficacy of the inoculation. I am sorry to say that among my servants, in their own quarters at Ganeshkhind, we have had a number of cases. The exact figures up to date, which it is fair to take, are as follows:—There have been 324 inoculated and 300 uninoculated. A very great many more have been inoculated, but so lately that it is not fair to bring them into the calculation. We have been so unfortunate as to have fourteen cases among the servants and their families; every one of those cases has been from among the 300 who were not inoculated. I have only one thing more to say, and that is, that Major Bannerman is not confining his work entirely to that which he has undertaken in connection with prophylactics. In his spare time he is engaged in making a bacteriological and chemical analysis of the atmosphere and ground air in the district of Nagpada, which will be extremely interesting in itself, and also in the future will be of infinite use for comparison. Where, however, this "spare time" comes in I cannot exactly say, but that is Major Bannerman's affair. I am very glad to say that the new scheme for Nagpada is now on the eve of obtaining the formal sanction of Government. (Applause.) I beg to thank you, Major Bannerman, in the name of this assembly, for the lecture you have given us.'"

† For Belgaum figures, see Chap. I, Pt. IV., Inoculation.

The present staff consists of two Commissioned Medical Officers, I. M. S., four Special Plague Medical Officers appointed by the Secretary of State for India, one local medical man, two assistant surgeons, seven clerks, seven decanters, one engineer, and twenty Laboratory attendants. Total 45, exclusive of Mr. Haffkine, who is at present on leave; Major W. B. Bannerman, I. M. S., holding charge of the Laboratory till his return.

The number of doses sent out up to date is over 1,000,000, and the daily output is close on 10,000 doses.

Plates 1 to 10 may be of interest as shewing the past and present staffs of the Laboratory, the different processes in the manufacture of the vaccine, and the operation of inoculation on a person. As a description is appended to each plate, further comment here is unnecessary.

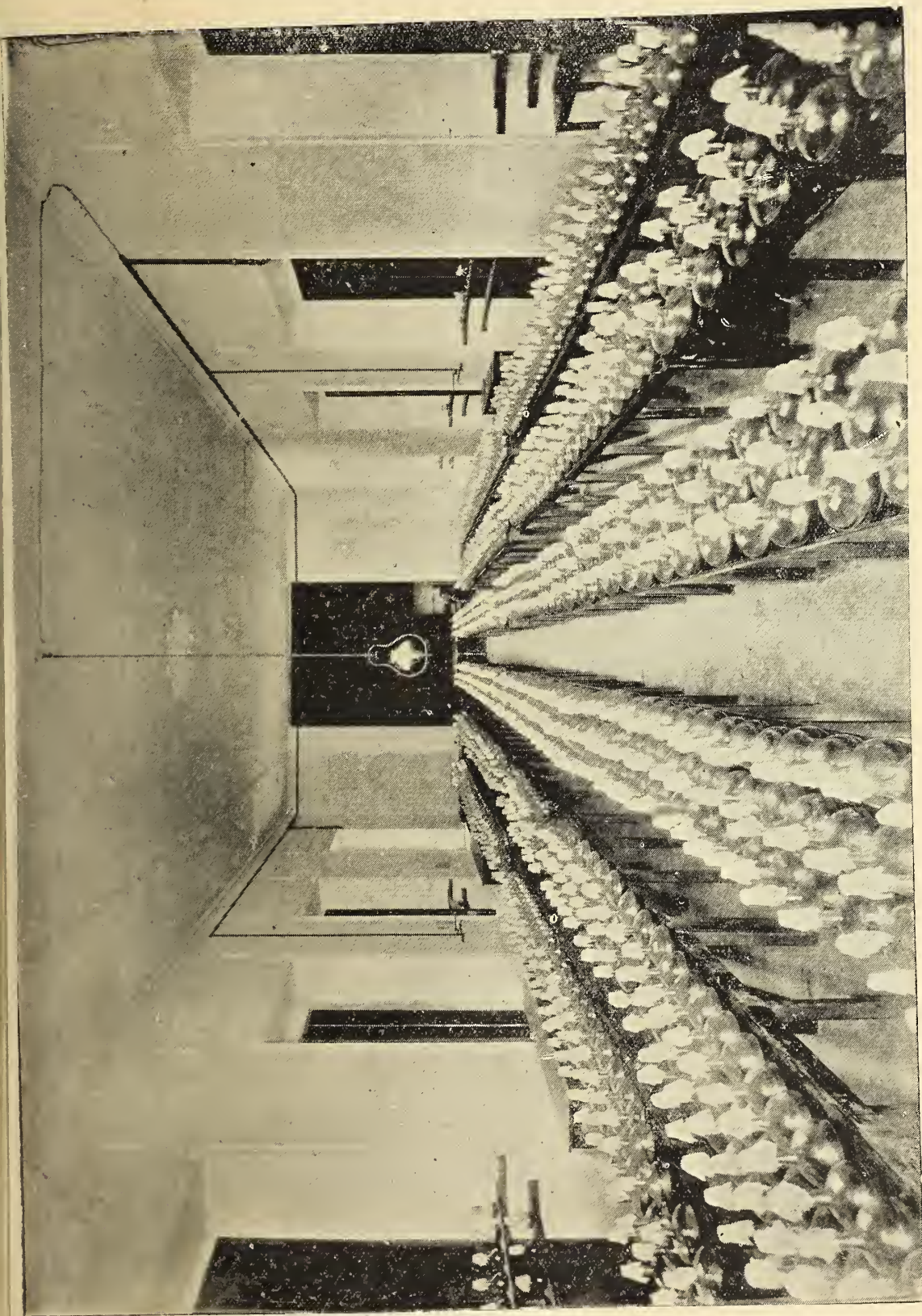


PLATE 8.

Plate 8.

THE DARK FERMENTATION ROOM (formerly the Governor's Banqueting Hall).

This view was taken a few days before H. E. the Viceroy inspected the Laboratory on 8th November, 1899.

The room then contained 1,238 flasks, containing 2,058 litres of fermenting bouillon, weighing 2 tons, 1 cwt., or about 411,600 adult doses of vaccine. The flasks are kept in this room for 6 weeks or 2 months, to permit fermentation ; being shaken every two days. They are then tested for purity, sterilised, and decanted (*v. pl. 9*).



PLATE 9.

Plate 9.
THE DECANTING ROOM.

The vaccine, after being sterilised by heat, and carbolicised, is here decanted into sterilised bottles, by means of glass syphons; one of which may be clearly seen in the flask in the left hand corner. The basin from which the decanter is lifting an india-rubber stopper, is filled with formaline solution for the disinfection of the stoppers. Behind this basin may be seen the sterilised bottles plugged with cotton. At the second table on the right, bottles are being filled from the syphons. At the far end of the room the filled bottles are being labelled and capped. The Assistant Surgeon on the right is examining an agar tube used for testing the sterility of the vaccine.

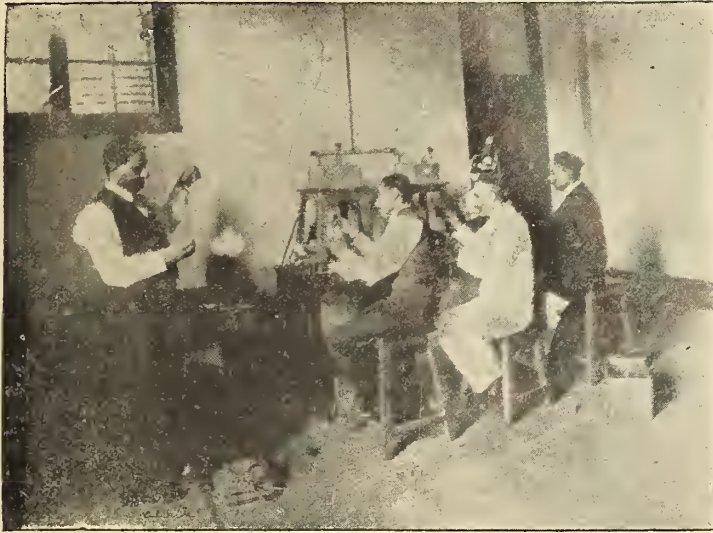
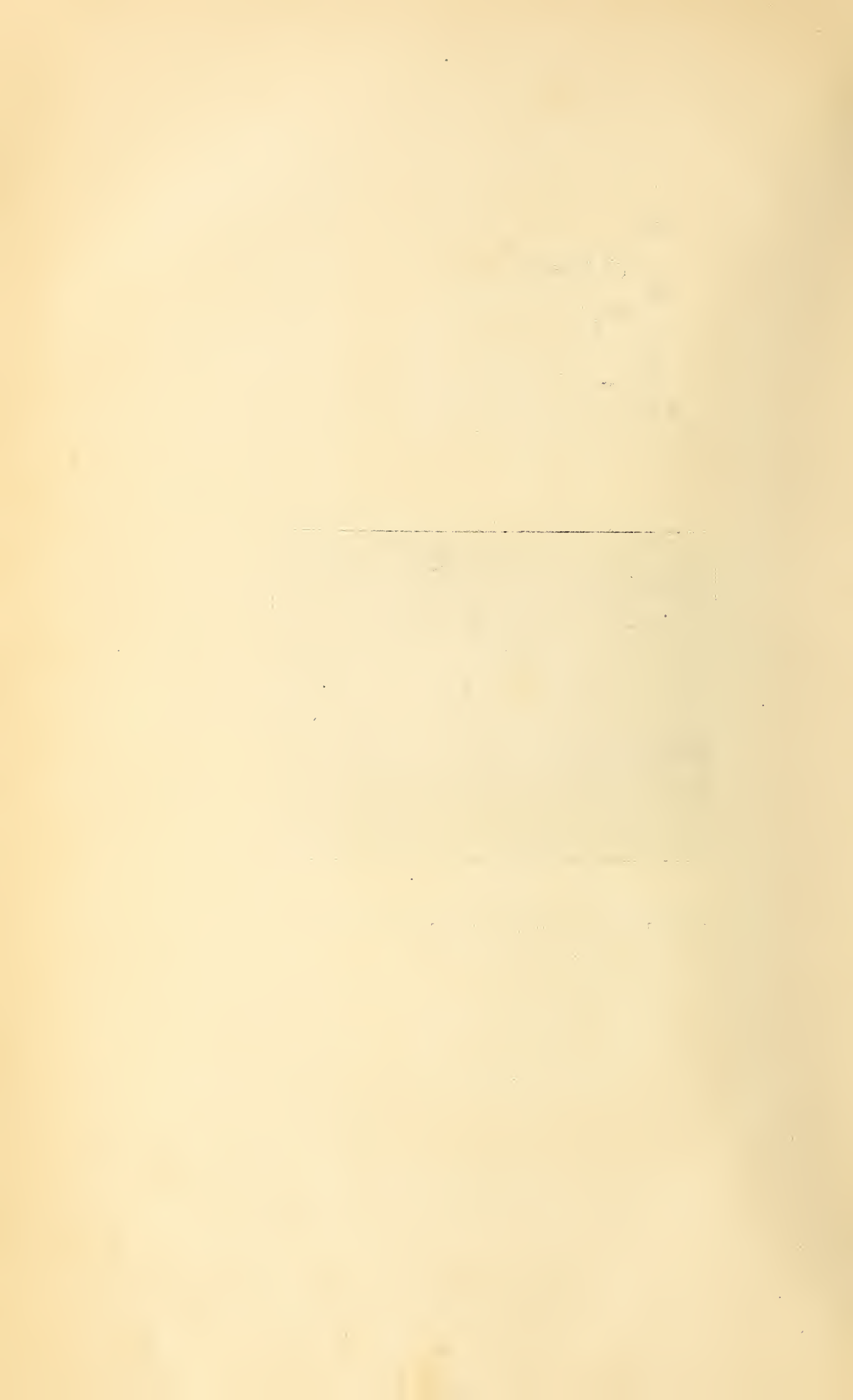


Plate 10.

Assistant Surgeons decanting the Vaccine into small sterilized bottles.
(Khushru Lodge, 1898.) A comparison of this plate with plate 9 will show
the enormous increase in the scale of the operations.



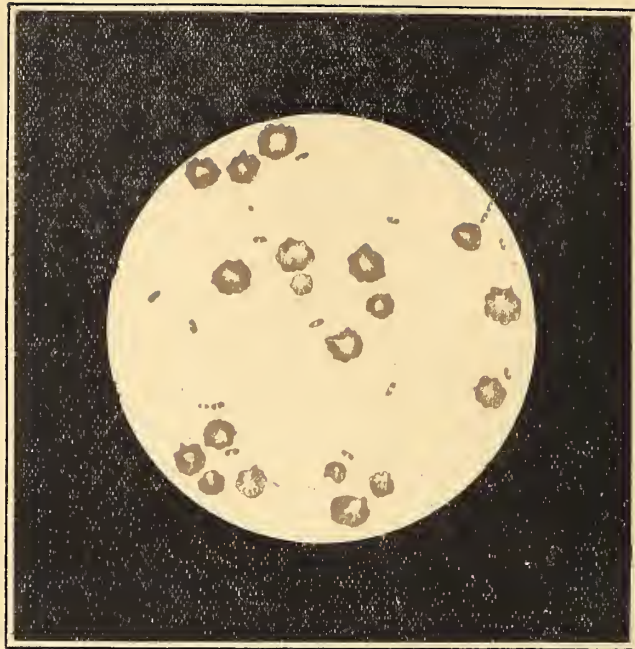


Plate N° I

Blood of rat which had died of Plague to show
bipolar staining Gentian Violet X 1000



Plate N° II

Plague Bacilli from a 24 hours' growth on
Agar Agar. Gentian Violet X 1000.

CHAPTER III.

Part II.—The Bacteriology of Plague.

Plague is an acute disease caused by a bacillus belonging to a class of specifically pathogenic micro-organisms, whose morphological and other characters show considerable resemblance. Such organisms are those of swine-fever, chicken-cholera, &c., (*Klein*).^{*} To a Japanese investigator—*Kitasato*—belongs the honour of having first identified the organism of plague. This he did in 1894, when plague was raging in Hongkong, and his results have since been verified and amplified by numerous observers throughout the world, but more particularly in India, which has now been for 3 years the most important focus of the disease

THE BACILLUS OF PLAQUE—‘BACILLUS PESTIS ORIENTALIS’ (*Kitasato, Yersin*).

The plague-bacillus, as it appears in microscopical specimens from the blood and tissues of animals, is a short rod with rounded ends, 0.8μ . to 1.6μ . in length, and less than half that in breadth. It is sporeless, and non-motile in the ordinary sense of the word.[†]

The bacillus is stained readily by the ordinary basic dyes. A weak solution of Carbol-Fuchsin or of Aniline-Gentian-Violet applied for 1—2 minutes will be found satisfactory for ordinary purposes. On examination, such stained specimens taken from tissues show an intensification of colour at the poles (*vide* Plate I.) which is very characteristic and careful focussing discloses also an appearance like a capsule. But it is doubtful if this capsule is a true one.

The bacillus does not retain the stain by Grams' method.

In ordinary bubonic plague in man the micro-organism is found in the bubo. Just before death it is often found in the blood, but in septicæmic cases it appears in that fluid in the early stages of the disease. It is noteworthy that the presence of the bacillus in the blood does not necessarily indicate a fatal attack. In pneumonic cases plague-bacilli may be demonstrated in the sputum.

In *post-mortems* of ordinary bubonic plague cases the bacilli are found not only in the bubo, but in great abundance in the blood and in the liver and spleen. Sometime these organs may be swarming with bacilli, while the blood is almost free. This occurs more frequently in rats than in man. Dr. Bitter says there are relatively more bacilli in the spleen than in the other organs or tissues.

Bacilli grown artificially on solid media show in young cultures, after staining, appearances similar to those found in the tissues, except that they take the dye uniformly and seldom show the intensification of the stain at the poles mentioned above. Elongated forms are also to be noted, and are very characteristic. (*Vide* Plate II.)

If an *agar* culture be examined daily for some ten days, gradual changes in form and size and in effects of staining will be observed. The bacilli become swollen, assuming, after the first 2 or 3 days, lemon and pear shapes, and later exhibiting polymorphic

^{*} Metchnikoff, however, classifies the plague-bacillus, in a group of cocco-bacilli, along with *bacillus typh. abdominalis*, *bacillus coli*, etc., all characterised by the facility with which, at some period of their existence, they can be stained to show the bi-polar appearance.

[†] Mr. Morvyn-Gordon has stained flagella in specimens from an *Agar*-culture grown for 24 hours at 37° C.

figures—spindle, dumb-bell or disc-shaped—some of these being many times larger than the original bacilli. Such appearances are known as “*involution forms*,” and in the early days of plague bacteriology, *they were considered to be very important from a diagnostic point of view.* (*Vide* Plates III. and IV.)

A number of cultures were however found by Mr. Haffkine which did not show these appearances; and he afterwards found, in an enquiry made together with Major Bannerman, that these appearances belong to microbes taken recently from plague patients and that they gradually lose them in the course of cultivation in the Laboratory.

Mr. Hankin and Capt. Leumann aver that these forms are produced most readily by employing *Agar* to which an excess of salt has been added. Mr. Haffkine finds, however, that they are equally demonstrable, in cultures of bacilli taken direct from the body, on ordinary *Agar*, if it is “dry” and has a definite alkaline reaction: and adds that involution forms are most readily demonstrable on old and dry *Agar*, especially when it is inseminated very abundantly; and that they are never seen in liquid cultures, but can be observed in the tissues of animals.

Captain Childe reports that similar “rounded or swollen” forms are to be found in the tissues of the human body, if the examination be made from 5 to 12 hours after death; the change being, in his opinion, a *post-mortem* one. Mr. Haffkine had previously found such forms in the body of a rabbit, and suggested that they might be present in human bodies also.

The bacilli cultivated in *Bouillon* show a tendency to form short chains of 5 or 6 bacilli (*vide* Plate V.)—each chain showing generally a slight but very remarkable bend: but this latter characteristic is not yet perhaps fully established. They also stain evenly and very deeply, but in old cultures most of the bacilli disintegrate and they do not then take the stain well.

The plague-bacillus forms characteristic appearances on most of the common media.

Biology and cultural characters.	In India, for general work, preparations of <i>Agar-agar</i> are usually employed. Gelatine liquefies at the ordinary temperature of hot climates, and cool incubators, etc., are necessary for its use.
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In ordinary faintly alkaline or neutral peptone bouillon, and especially if a few drops of oil or fat (ghi, cocoanut, olive, or linseed oil) are added to it, the appearances known as “Haffkine’s stalactite growth” will be seen. Ten to twelve hours after insemination a diffuse cloudiness due to the universal growth of the bacilli throughout the liquid is to be observed. The diffuse cloudiness disappears later on, and colonies of bacilli are to be seen hanging from the surface in stalactite form, sometimes reaching to the bottom or sides of the flask to which they may be attached. These colonies, thin, and more or less numerous at first, quickly increase in size and number so as to form a thick jungle of stalactites. This appearance is, so far as we know at present, <i>absolutely diagnostic of plague</i> . Sometimes no stalactites are to be seen in the beginning, but white spots, due to the zooglic masses of bacilli, appear on the sides of the flask and on the surface of the liquid. Later on, when the stalactites appear, these white masses of growth are found to correspond to the points of attachment of the stalactites. (<i>Vide</i> Plate VI.)	
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This stalactite growth is very fragile, and for its proper development requires that the bouillon be kept *absolutely at rest*. A solid table in a dark room on the ground floor should therefore be chosen for the resting place of the culture flask; and a convenient method of displaying the growth is to hold a light behind the flask and to look through the fluid from the opposite side.



Plate N° III

Involution forms from a 4 days old culture
on Agar Agar Carbol Fuchsin X 1200



Plate N° IV

Involution forms from a 4 days old culture
on Agar Agar Gentian Violet X 800



Plate N° V

Plague Bacilli in chains from a 2 days' old growth in bouillon.



Plate VI
Haffkines "Stalactite growth"



If the flask containing the stalactite formation be gently moved, the appearance of a snow-fall is produced—each stalactite apparently rolling itself into a small mass and falling to the bottom (*vide* Plate VII.)—the supernatant fluid becoming again perfectly clear. Then a fresh surface growth with stalactites shorter than the first is produced—again to fall in snow-like flakes on agitation. A series of crops of stalactites may thus be observed in a culture flask until the nutritive material is exhausted.

As mentioned above, in bouillon cultures, inseminated from animal bodies direct, or from even fresh cultures from animals, it sometimes happens that stalactites do not readily appear: the persistency of the zooglic stage in such cases being remarkable. Gently agitating the flask will have the effect in these cases of causing the stalactite growth to appear after a lapse of from 24 to 36 hours. It must be noted that the stalactites thus produced from a recent animal culture are finer and scantier as a rule than those which are the result of inoculating a flask with an old and artificial growth. Very old cultures, re-transplanted, often, however, show very ragged stalactites.

In *milk* the growth is not distinctive. Klein says that
Growth in milk. after a month's incubation at 37° C. in litmus milk, curdling
and a change of reaction will occur.*

The growth on *Agar*—(Peptone-Salt Agar)—is characteristic, provided the culture material has been evenly spread over the surface of the slant, and also that the *Agar* is “dry.” If these conditions are fulfilled, Growth on *Agar*.
in 24 hours at the temperature of the air [in Bombay (25·5–29·8° C.), minute grey translucent colonies cover the whole surface of the *Agar*—the appearance, when held up to the light, and looked at from below, being similar to that of fine ground glass. With age the culture deepens lightly and reaches a maximum in about 5–7 days. Here and there more opaque colonies will often be noticed, and these eventually become very prominent and of a faintly yellowish-brown colour. These are “Giant Colonies,” and they often appear to contain more elongated forms than the rest of the culture. (*Vide* Plate VIII.) These were originally termed “Cannibal Colonies” by Mr. Haffkine.

Isolated colonies on the surface of *Agar*, examined under a magnification of 75 diameters with transmitted light, show after 24–36 hours' growth a raised angularly-marked centre, with a faint marginal layer which has an uneven border. In 3 to 4 days this centre thickens so as to become opaque and brownish in colour. It then forms a regular oval or circular shape, surrounded by the flat uneven clear margin, which is now plainly defined and sometimes shows radiate markings. Occasionally such colonies go on growing until they become 5–7 cm. in breadth, and to the naked eye appear to exhibit raised concentric rings around the nucleus-like centre. (*Vide* Plates IX and X.)

The appearances produced by the growth of the plague-bacillus on gelatine are somewhat similar to those already described on *Agar-agar*. Klein*
Growth on gelatine. states that on gelatine-plates grey punctiform translucent colonies occur after 24 hours' incubation at 20–21° C. They are visible to the naked eye. Later (3–7 days) the superficial colonies become larger greyish-white patches distinctly raised in the centre. Their margins are distinctly angular or crenate, and, according to McFarland,† they often show a fine semi-transparent zone around the central part, which appearance has already been noted with regard to the growth of

* 26th Annual Report of Medical Officer to Local Government Board—1896-97.

† Pathogenic Bacteria, J. McFarland, Henry Kimpton, 1898.

isolated colonies on agar-agar. The deeper colonies are, as in agar, small and spherical, white in reflected and brown in transmitted light.

Gelatine-streak cultures, according to Klein, are not unlike those of diphtheria, consisting of a whitish band, increasing in thickness with an irregular-knobbed margin.

As in *Agar*, the stab-culture growth in gelatine is not remarkable to any degree. No liquefaction of the gelatine occurs, nor does this phenomenon occur in any other solid media.

On *blood serum* a rich faintly yellowish-grey moist scum is developed.

On *potato* and *banana* the plague-bacillus grows very scantily, and the appearances produced are not noteworthy.

According to the German Plague Commission, in ordinary tap water, after five days	the virulence of the microbe is lost, and, similarly, in sterile
Growth in water.	tap water after ten days.

By drying, exposure to direct sunlight or by heating at 60° C. for 5 minutes (Klein)	the vitality of a plague culture is destroyed. Live plague-
Effects of disinfectants on the plague-bacillus.	microbes, spread as a thin layer on a slip of glass, and exposed

directly to the sun's light, are killed within an hour. With a thicker layer the bacilli remain alive and virulent for about two hours, but not longer than four hours. Cultures growing on *Agar* live for several hours, but a day's exposure kills them outright.

In the words of the German Plague Commission (*loc. cit.* p. 281):—"The bacilli are very little resistant to external influences, *e. g.*, drying, disinfectants, sunlight and ordinary water; and as no spores are found, their propagation through the dust of the air, especially in tropical countries, where they are quickly killed by sunlight and drying, certainly does not usually occur; only dried organisms being capable of dissemination by the atmosphere. But, as the conditions for the inimical action of such physical agencies as sunlight, drying, etc., are not always so favourable under natural conditions as in actual experiments, resort to artificial disinfectants is made necessary in practice."

The effects of various antiseptics and disinfectants on plague cultures have been thoroughly studied by Messrs. Hankin, Pitchford and Marsh and the German Commission. The former found that Corrosive Sublimate is the most reliable for general use, and that a solution of 1—5000 was sufficient to destroy the vitality of the plague-bacillus in 5 minutes. 1—1000 is stated by the German Commission to destroy a culture at once. To Carbolic Acid and its allies and alkalies the bacillus was more resistant than to acids and various oxidising agents, particularly Chloride of Lime and Permanganate of Potash.

Animals of several species whose habit of life brings them into contact with human habitations, are naturally more susceptible to plague than others. Such are rats, monkeys, and squirrels.* When plague was at its height in Bombay, guinea-pigs and rabbits in confinement were attacked by the disease in an epidemic form, and there is little doubt but that rats were instrumental in originating the outbreak. Rats are particularly affected by the disease, and they are, in all probability, the chief disseminators of infection. The ordinary brown rat of Bombay is the most liable to be attacked, while the musk rat appears to be immune. Mice, too, are less susceptible than rats.

* Corthorn and Milne in the *Indian Medical Gazette* for May 1899.



Plate VII
"The Snowfall."

If a rat is artificially inoculated with a very minute quantity of a virulent plague culture, death generally ensues in 24—48 hours. After about 10 or 12 hours the rat looks very ill. It sits huddled up in a corner of its cage, and is disinclined to move or eat. Difficulty of breathing gradually supervenes, and increases in amount until suddenly about half an hour before death the animal falls on its side in extreme prostration. Convulsive dyspnœa, twitchings of the limbs and tail, rapid and strong at first, but quickly weakening, cease in death. Fæces and urine are voided involuntarily and not infrequently a paralysed condition of the lower limbs is obvious long before the final seizure.

On opening the animal a hæmorrhagic œdema at the seat of inoculation is noticeable. Similar conditions often exist in the inguinal, cervical, and axillary regions, but glandular enlargements are seldom, if ever, visible to the naked eye. The heart is engorged with dark fluid blood, teeming, as a rule, with plague-bacilli. The lungs are collapsed and show pneumonic patches. Drs. Gibson and Ransome have observed in rats appearances similar to that of true pneumonic plague in man. The liver and spleen are both enlarged. The latter is often double its normal size. Bacilli are easily demonstrable in these organs. The bladder is frequently distended with urine, and in a few instances plague-bacilli have been obtained from this source.

In a country like India, where the decomposition of organic matter is accelerated by climatic conditions, putrefactive bacteria rapidly outgrow the plague-bacilli, and after 12 hours at the most the chances of isolating the plague-bacilli by culture from such organic matter are very remote.*

Klein and other observers remark that passage of the bacillus through several animals of the same species has the effect of increasing the virulence of the micro-organism, at least for that species. Dr. Balfour-Stewart † has recently noted that if a series of rabbits be inoculated with increasing doses of a 10 days' culture of living plague a greater proportion of those receiving a large dose survive, than of those injected with the smaller quantities. This he thought due to the fact that the larger doses contained a larger amount of immunising constituent, and so rendered the inoculated animal immune to the microbes contained in the culture injected.

Dogs, cats, ‡ horses, cattle, sheep and goats are not susceptible to plague; although inoculation with plague cultures causes in them a distinct febrile and local reaction. Goats appear to suffer most. Not infrequently they slowly sicken and die—a fact which has been occasionally observed in rabbits also.

Birds are apparently immune. Sick pigeons and crows have been examined at the Laboratory, but the plague-bacillus has never been isolated from them.

The rôle of insects in the propagation of disease is attracting attention. In relation to plague, Yersin has stated that he has found the bacillus in flies, while the German Plague Commission infected guinea-pigs with an emulsion made from fleas taken off a rat.

Our knowledge of the plague-bacillus outside the bodies of affected animals and apart from the artificial conditions already detailed is practically nil.

* Corthorn and Milne in the *Indian Medical Gazette* for May 1899.

† *British Medical Journal*, 2nd September 1899.

‡ The reports received therefore of cases of plague amongst cats would appear to be incorrect; no bacteriological examination having been made.

On the analogy of similar diseases we presume that persons suffering from plague infect their clothes, beds and other room surroundings. Hence for these latter we employ various methods of disinfection and we draw our conclusions as to the particular disinfectant to be used--its form and its strength--from the laboratory experiments which have been performed in this connection.

With regard to the presence of the plague-bacillus in air--in water or in the soil--it is impossible at present to make any assertion whatsoever with the insufficient data which we possess. Hitherto all attempts (many of which have been made by Dr. Gibson, Lieut. Liston, and others) to isolate the plague-bacillus from the soil have failed.



Giant Colony



Plate VIII

Growth of Plague on Agar — Agar,
Ground Glass Appearance
Natural Size.



Plate IX

Single old Colony on Agar
6 or 8 times natural size

*N.B. The yellow appearance of the above is largely due to the
colour of the subjacent agar jelly.*

Drawn by Gouveya

Litho: Govt Photozinc: Office, Poona 1900



Plate X

B. Pestis to show appearance of large colonies.

Natural size Agar growth.

CHAPTER IV.

TOWN AND ISLAND OF BOMBAY.

Bombay City is a narrow island, some eleven miles long by three broad. It is joined to the larger island of Salsette (some twenty miles by ten) by two causeways and two railway lines. Bombay Harbour and Bassein Creek separate these two islands from the mainland of India. It has already been stated that the existence of bubonic plague in Bombay City was first discovered in the latter half of September 1896. The various theories as to its origin may be briefly summarized as follows: (1) Importation from Hongkong, where a plague epidemic was then raging; (2) importation from one of the Red Sea ports; (3) importation from Mesopotamia; (4) importation from Egypt; (5) importation from Persia, or from the Levant. The most popular of these theories is that which ascribes the origin to Hongkong; but there cannot be said to exist the least evidence in favour of any one theory over any other.

The administrative measures taken in Bombay from September 1896 to May 1897 are treated in great detail in Nathan's and Couchman's Reports. Those for the year May 1897 to May 1898, together with some information on the symptoms and medical aspects of the disease, are given in General Gatacre's and in Sir James Campbell's Reports, while both these branches are very fully dealt with in Mr. W. L. Harvey, the Municipal Commissioner's Report for 1898-99.

It would therefore be clearly superfluous to deal at any length here with the epidemics in Bombay City; and for information under this head, therefore, the above works should be consulted.

On the other hand, both for the sake of completeness, and because Bombay City is the Capital of the Presidency, and the starting point, both of the disease, and of the various measures introduced at different times to combat it, a brief outline, as well of plague administration, as of the progress of the pestilence in the City, is given below.

Up to the end of the year 1896, plague did not assume any formidable proportions. The measures taken to suppress it were both prompt and vigorous: sanitation of the infected portions of the city where it seemed to be required was at once energetically taken in hand; houses and gullies which lay under any suspicion of infection were at once flushed and disinfected; drains were opened up, remodelled, and repaired; manholes were carefully disinfected, drains being thoroughly flushed with sea-water and carbolic acid which was poured into them by a centrifugal pump at the rate of 3,000,000 gallons a day; all cases of fever were treated as "suspects"; segregation of contacts and removal to hospital of all plague patients was strictly enforced.

But the presence of the dread disease itself, combined with these stringent precautions soon produced an unreasoning panic throughout the City, which resulted at first in flight and concealment and afterwards in open opposition. Mr. Snow, the then Municipal Commissioner, writes of this period: "Of all the measures taken at this time for combating plague, the one which caused most alarm was segregation or removal to hospital. The people not only regarded hospital treatment with detestation, but reports were freely circulated that the authorities merely took them there to make a speedy end of them. A gang of scoundrels took to blackmailing by personating the Police and Municipal servants, and increased the general terror, extorting money as they did under threats of removal to hospital. Several of these free lances were at

last brought to book by the Police, and with a few salutary convictions and sentences by the Magistrates, that danger disappeared. None the less surely, however, the panic increased, and while our Municipal employés showed signs of wavering, the great body of mill-hands began to be infected by the general alarm and flight of so many persons from the City."

It was from the mill-hands, indeed, that danger threatened, and that danger came. On the 10th of October a number of them assembled outside Arthur Road Hospital, threatening violence and its speedy demolition. After causing great alarm in it they dispersed. On the 29th about 1,000 of them attacked this same hospital with sticks and stones, entering the compound, injuring the building, striking the patients, intimidating the staff. Nor was order restored until the arrival of the Commissioner and Deputy Commissioner of Police, with a strong force of European and Native Constables. This demonstration was directed against segregation and removal to hospital, the one measure which the whole people, high and low, viewed with the wildest hostility. The gravity of the situation induced the Municipal Commissioner, after conferring with the Commissioner of Police and the Health Officer, to somewhat relax the stringency of these two measures; but "it must not be supposed," he writes, "that all attempts at isolation were given up." This unreasoning fear of plague hospitals extended at first even to hospitals established and managed by Hindoos for their own caste fellows. As early as October such hospitals were opened in Mandvi and Bhuleshwar, but were rendered useless by this attitude.

At this time, October 1896, the power to deal with plague had been vested by Government in the Municipal Commissioner; it remained vested in him till the appointment of the first Plague Committee on the 5th of March 1897. This Committee consisted of Brigadier-General Gatacre, Mr. Snow, Surgeon-Major Dimmock, and Mr. James, Deputy Executive Engineer. Its Secretary was Major Cahusac.

It should be mentioned here, however, that a Committee consisting of Dr. Lowson, Surgeon-Major Reade, and Surgeon-Captain Beveridge (who had had previous experience in Hongkong) was appointed to enquire into, report on, and suggest measures to combat the progress of the disease throughout the Presidency. Of this Committee, which was dissolved in the latter half of 1897, Surgeon-Major Reade is the only member at present remaining in the Presidency. He was appointed to Poona at the end of 1897, or the beginning of 1898, being shortly afterwards appointed Chief Plague Authority in that city.

To return to the original Committee for Bombay City. The Committee, though not dissolved, underwent considerable changes of *personnel*. The first of these was the instalment of Sir J. Campbell as President on General Gatacre's departure from India in July 1897. This was followed shortly afterwards (August) by the substitution of Mr. Vining, R. N., for Major Cahusac as Secretary; and by the successive appointment to the Committee (towards the close of the year) of Surgeon-General Bainbridge; and, in the beginning of 1898, of Surgeon-Colonel Hay and Mr. Playford Reynolds, Superintending Engineer, who were added in order to strengthen it.

The plague administration of Bombay City remained in the hands of this Committee from March 1897 to May 1898, when, on Sir J. Campbell's departure from India, it was replaced by an entirely new system. This consisted in the abolition of the Plague Committee, the re-vesting of all plague control in the Municipal Commissioner and a deputy, who was specially appointed for this purpose. As the orders inaugurating this radical change do not appear to be fully quoted in any report previously published, they are given in full here. The scheme was briefly as follows. A Plague Commissioner was appointed for the whole Presidency, who

was and is under Government the Supreme Plague Authority in the Presidency, as well for the centralization and concentration of control, as for the quick despatch of business. The Plague Commissioner was shortly afterwards also appointed Secretary to Government in the Plague Department. The first of these Plague Commissioners was Sir Andrew Wingate, who, in the beginning, had two colleagues (Surgeon-General Cleghorn and Surgeon-Col. Hay), also termed Plague Commissioners: and who was appointed Joint Secretary to Government in charge of the Plague Branch of the General Department in addition to his duties as Plague Commissioner by Government Resolution No. $\frac{7150}{50662}$ of 22nd December 1897. These three Plague Commissioners toured throughout the Presidency, visiting those places where plague was worst. The office of Plague Commissioner was for a brief period held also by Mr. A. Cumine, I. C. S., who took over from Sir A. Wingate on the 6th June 1898.

On the 3rd of September 1898, Sir Andrew Wingate again took up the Plague Commissionership and Secretaryship to Government, which post he held till his departure from India on furlough in May 1899. Mr. A. F. Woodburn, I. C. S., succeeded him.

To return to the City. On the departure of Sir J. Campbell and the abolition of the Plague Committee in May 1898, the system described above was introduced, Mr. W. L. Harvey, I. C. S., being appointed Municipal Commissioner, and Mr. J. H. DuBoulay, I. C. S., Deputy Municipal Commissioner, for plague operations. The following is a full text of the orders:—

General Department (Plague).

No. $\frac{3018}{3397-P.}$

Bombay Castle, 27th May 1898.

RESOLUTION OF GOVERNMENT.

His Excellency the Governor in Council is pleased to direct that the responsibility for all plague operations in Bombay shall be undertaken by the Municipal Commissioner subject to the direct control of the Plague Commissioner as representing Government and their expert advisers.

To assist in the management of plague operations His Excellency the Governor in Council is pleased to approve the appointment of a Special Deputy Commissioner, who will be invested, under the Epidemic Diseases Act, with all the powers of a Deputy Municipal Commissioner under the Bombay Municipal Act. Later on, it may probably be necessary for the Municipal Commissioner to apply to the Corporation for a Second Deputy Commissioner.

His Excellency the Governor in Council is further pleased to approve the appointment of a special medical officer for the charge of Plague Hospitals and other plague medical duties, who will be deemed to be a Joint Health Officer under the Municipal Act and will be invested with all necessary powers in that behalf.

It will be for the Municipal Commissioner, in consultation with and subject to the control of the Plague Commissioner, to maintain or reduce the existing organization and from time to time to increase establishments as may seem necessary, subject to the general or special orders of Government.

The Municipal Commissioner will be responsible for securing the loyal co-operation of all officers and departments subordinate to him (whether ordinary or special) in giving effect to any measure approved by the Plague Commissioner, and Section 522 of the City of Bombay Municipal Act shall be deemed to govern the conduct of the Police in regard to any such measure.

(Sd.) A. WINGATE,

Secretary to Government."

"General Department (Plague). No. $\frac{4516}{4779-P.}$

Bombay Castle, 12th August 1898.

RESOLUTION OF GOVERNMENT.

The following Notification should be published in a *Bombay Government Gazette Extraordinary*:—

"Whereas certain parts of India are visited by, and others threatened with, an outbreak of dangerous epidemic disease known as Plague; and whereas the Governor General in Council, in exercise of the powers conferred by Section 2, Sub-section 3, of the Epidemic Diseases Act, has been pleased to direct that the powers conferred by the said Act may, within the Presidency of Bombay, be exercised by the Governor of Bombay in Council; and whereas the Governor in Council thinks that the ordinary provisions of the law for the time being in force are insufficient to prevent the spread of this disease, he is pleased, in supersession of the Notifications of Government in the General Department specified in the margin, and in modification of Government Notifications Nos. 5279—3434-P., dated 29th September 1897, and 327—360-P., dated 18th January 1898, to direct as follows:—

Government Notification No. 1204—702-P., dated 5th March 1897.
 Government Notification No. 3250—2402-P., dated 12th June 1897.
 Government Notification No. 56—56-P., dated 5th January 1898.
 Government Notification No. 137—150-P., dated 8th January 1898.
 Government Notification No. 943—1148-P., dated 15th February 1898.

The Municipal Commissioner, Bombay Municipality, is empowered to carry out, subject to the control of Government exercised through the Plague Commissioner, all the measures to be taken to suppress and prevent the spread of plague in the City of Bombay, and he shall take such measures as Government, through the Plague Commissioner, may order him to take in this behalf.

For the said purposes the Municipal Commissioner, in addition to the powers conferred on him by the Bombay City Municipal Act, 1888, by the Government Notifications marginally specified, and by the Notification of the Municipal Commissioner, dated 6th October 1896, is invested with the following powers:

(1) To appoint special officers either by name or by virtue of office to carry out or perform under his general direction any measures or acts devised or ordered by him to be taken for the suppression or prevention of the spread of plague. Such special officers may be known as 'Plague Authorities' and their powers and duties may be limited as directed by the Municipal Commissioner and their appointment shall be subject to revocation at any time by the Municipal Commissioner. Any Plague Authority so appointed may be empowered by the Municipal Commissioner to direct or cause the removal, to a hospital or other place appointed for the purpose, of any person in respect of whom a certificate has been made in the manner hereinbelow provided in clause (5) of paragraph 3 of this Notification.

(2) To exercise, in lieu of the Bombay Plague Committee, the powers of a Commissioner under Rule 29 and the powers of a District Magistrate under Rules 19 and 28 of the General Plague Rules for the Mofussil as applied to the City and Island of Bombay by Government Notification No. 5279—3434-P., dated 29th September 1897, and Government Notification No. 327—360-P., dated 18th January 1898, respectively.

(3) To close the Máhim-Bándra and Sion Kurla Causeways from time to time, as he may deem necessary, and further to examine all persons crossing the said causeways at the permitted times, and, if necessary, to detain and send to hospitals or other places appointed for the purpose persons found or believed to be suffering from the plague.

(4) To take possession of and occupy any vacant ground or empty building for the purpose of any camp, hospital, latrine, deposit of sweepings, warehouse or office, and to determine such monthly rent or other compensation as should thereafter be paid to the owner of such land or building taken possession of and occupied for the said purposes.

Mr J. H. DuBoulay is appointed to assist the Municipal Commissioner in the management of plague operations. He shall exercise such of the powers and perform such of the duties hereinbelow mentioned as he may be directed to exercise or to perform by the orders of the Municipal Commissioner, and he shall be styled Deputy Commissioner for plague operations. For the said purposes Mr. DuBoulay is invested with the powers conferred on the Municipal Commissioner by Government Notifications Nos. 228-P., dated 10th February 1897, 4691—3120-P., dated 30th August 1897, and 2675—3027-P., dated 10th May 1898, and in addition is invested with the following powers, viz.:

(1) To inspect any building or other premises for the purpose of ascertaining the sanitary condition thereof, and if it shall appear to him necessary for sanitary reasons so to do, to require the owner or occupier of any building so inspected, to cause the same or some portion thereof to be limewashed or otherwise cleansed, either externally or internally, or both externally and internally.

(2) If it shall appear to him that any premises are in a neglected, unwholesome or filthy condition, or, by reason of their not being properly enclosed, are resorted to by the public for purposes of nature, or are otherwise, in his opinion, a nuisance to the neighbouring inhabitants, he may, by written notice, require the owner or occupier of such premises to cleanse, clear or enclose the same.

(3) He may at any time, by day or by night, without notice, or after giving such notice of his intention as shall, in the circumstances, appear to him to be reasonable, inspect any place in which any dangerous disease is reputed or suspected to exist, and take such measures as he shall think fit to prevent the spread of the said disease beyond such place.

(4) If it shall appear to him that the water in any well, tank or other place is likely, if used for drinking, to engender or cause the spread of any dangerous disease, he may, by public notice, prohibit the removal or use of the said water for the purpose of drinking, and no person shall remove or use for the purpose of drinking any water in respect of which any such public notice has been issued.

(5) On a certificate signed by any duly qualified medical practitioner, he may direct or cause the removal, to any hospital or other place appointed for the purpose, of any person, wheresoever found and whether provided with proper lodging or accommodation, or not, who is, in the opinion of such medical practitioner, suffering from plague; and the person, if any, who has charge of a person in respect of whom such order is made shall obey such order.

(6) If he is of opinion that the cleansing or disinfecting of a building or of a part of a building or of any article therein likely to retain infection would tend to prevent or check the spread of plague, he may, by written notice, require the owner or occupier of such building to cleanse or disinfect such building or part thereof or article therein, and if it shall appear to the said Deputy Commissioner necessary, to vacate the said building for such time as shall be prescribed in the said notice: provided that if, in the opinion of the said Deputy Commissioner, the owner or occupier is from poverty or other cause unable effectually to comply with such requisition, he may cause the building or part of the building or article likely to retain infection to be cleansed or disinfected, and defray the cost of so doing.

(7) (a) If he is of opinion that the destruction of any hut or shed is necessary to prevent the spread of any dangerous disease, he may, after giving, to the owner or occupier of such hut or shed, such previous notice of his intention as may in the circumstances of the case appear to him reasonable, take measures for having such hut or shed and all the materials thereof destroyed.

(b) Compensation may be paid by him, in any case which he thinks fit, to any person who sustains substantial loss by the destruction of any such hut or shed; but except as so allowed by the said Deputy Commissioner, no claim for compensation shall lie for any loss or damage caused by any exercise of the power conferred by this rule.

(8) He may direct any clothing, bedding or other articles which, in his opinion, have become infected to be taken for disinfection to such place as may be provided for the purpose by the Municipal Commissioner under the provisions of Section 427 of the Bombay City Municipal Act, 1888. He may direct the disinfection or destruction of bedding, clothing or other articles likely to retain infection, and may, in his discretion, give compensation for any articles so destroyed.

Brigade-Surgeon-Lieutenant-Colonel J. S. Wilkins is appointed Special Medical Officer for plague operations, for the charge of such plague hospitals and for such other duties in connection with plague operations as he may be directed to undertake by the Municipal Commissioner, and for the said purposes he is invested with the powers conferred on the Municipal Commissioner by Government Notifications Nos. 223-P., dated 10th February 1897, 4691—3120-P., dated 30th August 1897, and 2675—3027-P., dated 10th May 1898, and in addition is invested with the powers described in clauses (3), (4), (5), (6), (7) and (8)

of the last preceding paragraph of this Notification. He shall exercise such powers subject to the orders and the control of the Municipal Commissioner.

Any measures which may be ordered by the Municipal Commissioner or subject to his directions by the Special Deputy Commissioner for plague operations or the Special Medical Officer hereinbefore appointed, shall be carried into effect, without delay, by all public servants and all persons employed by the Municipal Commissioner for the purposes mentioned in and under the powers conferred by this Notification.

Save as may be otherwise directed by Government, all expenses incurred in carrying out such measures shall, in the first instance, be paid out of the Municipal fund of the City of Bombay, but the Municipal Commissioner or the Corporation may recover from any person any amount which such person would, under similar circumstances, be liable to pay to the Municipal Commissioner or the Corporation under the City of Bombay Municipal Act, 1888.

The Commissioner of Police shall give such assistance as may be necessary in order to enforce immediate compliance with any order issued by or with the sanction of the Municipal Commissioner under the powers conferred by this Notification.

(Sd.) A. CUMINE,

Acting Secretary to Government."

Turning now to the progress of plague in the City, the spread of the disease was at first gradual. Armies of rats, which had first infected, and then were in turn infected by, the locality in which they found themselves, fled from east to west, from west to north. In the wake of these fleeing armies of vermin followed the deadly pestilence. "The enquiries made," writes Mr. Snow, the then Municipal Commissioner, "showed that vast numbers of rats, flying from the danger of the pestilence, moved steadily in those directions, and were noticed in numbers in places where they had not before caused remark." At the beginning of December 1896 the epidemic became worse, and the total mortality of the City for the next three months averaged well over 1,500 per week.

It was during this period that the great exodus from the City took place; that while the City itself wore the aspect of a "City of the Dead," the Railway Stations teemed with masses of fleeing humanity. Special after Special bore away thousands of old and young, laden with enormous bundles representing their entire worldly goods. And as Special after Special left the station, disappointed crowds, rather than lose the next opportunity, settled down to wait on the platforms. Business was paralyzed, offices were closed, and thoroughfares, ordinarily teeming with life, were characterised by a desolate emptiness. By the end of January 1897 some 400,000 people—about one-half of the entire population of the City—had fled. This great exodus undoubtedly lessened the mortality. The weekly figures for this as well as for the succeeding epidemics are given in Appendix A. An important step taken in December may here be mentioned. Most of the dwellings of the poorer classes are of flimsy construction, easily saturated throughout by leaking pipes. Natives, moreover, habitually turn taps full on, whether to clean their clothes, bodies, their legs, arms or faces; and they as habitually avoid the trouble of turning off the taps when they have finished. A system of meters was repeatedly but unsuccessfully urged upon the Corporation. The only remedy was to cut off the water-supply. In December 1896 it was cut off from all houses in Kamatipoora, stand-pipes being erected in the streets for the people's use.

In January 1897 drastic measures were taken under Section 426 of the Municipal Act for the demolition of huts. The evacuation of infected houses was seriously considered, and the prevention of overcrowding was provided for by the powers conferred upon the Municipal Commissioner in a notification published in the *Gazette* of the 10th of February.

In March 1897 the epidemic slowly subsided, and by the middle of May the total mortality of the City had fallen to normal. During the months of April, May and June 1897 a large portion of those who had fled from the City returned. By the end of June, plague appeared to be on the point of extinction, and the population of the City was estimated at over 750,000. "At the beginning of August complaints were general, and to some extent well founded," writes Sir James Campbell, "that the City was infested with numbers of starved idlers whose feeble condition, predisposing to plague, was a menace to public health." Accordingly the question of relief was considered, 9,422 rupees were collected by subscription; 10,000 rupees more were received from the Secretary of the Famine Relief Fund; relief-works, consisting of filling-in low land, and of stone-breaking, were opened; and subsistence rates—3 annas per day for men, 2 annas for women, and $1\frac{1}{2}$ annas for children—were paid. The recipients of this relief numbered at the end of August 8,770 men, 1,952 women, and 33 children—a total of 10,755 persons. During September 15,033 persons were similarly relieved, and during October 17,925 received the same support.

Meanwhile, although the total mortality was some 200 above the average, the numbers of plague cases and deaths recorded was small. From the middle of May to the middle of November 1897, indeed the highest figures reported were 77 cases—60 deaths. In early December a second epidemic appeared probable: and two measures received special consideration. These were, first, the segregation of contacts; and second, the vacating of infected or unhealthy houses, together with the removal of the inmates to health camps. Both these measures were, without undue severity, enforced; private segregation camps were permitted; special leniency was shown to goldsmiths, weavers, and other craftsmen; detention was limited to 10 days, and might be reduced to 7; a modified system of surveillance was sanctioned; and every effort was made to redress reasonable complaints. With the increase in the epidemic at the beginning of 1898, certain measures were, after careful consideration, introduced for the first time, chief amongst these may be mentioned: (1) prevention of depopulation by flight; (2) notification of sickness; (3) corpse-inspection; (4) the securing of the correct address at which death took place. These measures, unfamiliar and inconvenient as they were, added to the fear of death, a constant presence of disinfection gangs, and the frequency of funerals, were not long in producing discontent. The perverse attitude now assumed by the people towards plague and plague measures, strengthened as it was by racial characteristics and innate prejudices, soon resulted in disturbances, which, on the 17th of March 1898, terminated in a riot.

It should here be mentioned that the military were largely employed during the first two epidemics for disinfection, search-work, and the keeping of order. They proved most useful.

The figures for this second epidemic were considerably higher than those for the first; but, taking into consideration the more numerous and stringent measures which undoubtedly lessened concealment, and the normal size of the population, it may be doubted whether the actual virulence of the second epidemic was any greater than that of the first.

The distinguishing characteristic of plague operations during the third epidemic was a definite system, methodically enforced. The original design comprised the division of the City into districts or wards; each ward to be in the charge of a Staff Corps Officer, assisted by a European Medical Officer and a district or ward Volunteer agency. The main scheme was successfully introduced and remains in force at the present time; but the paucity of Doctors who were

Second epidemic, 1897-98.

Third epidemic, 1898-99.

available for plague duty rendered it impossible to detail one to each district. As a matter of fact, only 5 such Doctors in all were employed, viz., Doctors Thomas, Parsons, Haydon, Dalal, and Lewis, the latter being the only one present during the epidemic of 1898-99.

The following table which gives the approximate dates of the beginning of the main outbreaks in each district or ward is taken from the Municipal Commissioner's Report:—

22nd November 1898—	2nd Nagpada.
29th „ „	—Fort North, Dongri, Kumbharwada, Mahim.
6th December „	—Market, Kharatalao, Byculla.
13th „ „	—Mandvi, Dhobitalao, Mazagon, Parel, Worli.
27th „ „	—Umarkhari, Bhuleshwar, Fanaswadi, Kamatipura, Tardeo, 1st Nagpada, Sion.
3rd January 1899—	Middle and Lower Colaba, Khetwadi, Girgaum, Tarwari, Sewri.
10th „ „	—Chukla, Mahalaxmi.
24th „ „	—Chowpatti.
31st „ „	—Walkeshwar.
7th February „	—Esplanade.

The poorer classes suffered most severely in this epidemic.

The great difficulty experienced with regard to health camps was that of space. Thirteen standing camps were taken over from the Plague Committee; of these, 8 were retained either wholly or in part; all the rest were demolished. Towards the close of 1898 a generous grant of one lakh by the Government of India for expenditure on camps greatly assisted the solution of the difficulty. In addition to the 8 camps abovementioned which were retained, over 20 more were established, the distribution of which is fully given in the Municipal Commissioner's report, and the cost of which was roughly Rs. 60,000.

These numerous camps in and about the City have undoubtedly been of the greatest service, furthering the evacuation of infected houses and localities, minimizing the inconvenience arising from such evacuation to the inmates, permitting of greater accommodation to the evacuated population and conducing generally to health.

As the Discretionary Relief Fund has been dealt with in a separate chapter by itself, and as full details of its working in Bombay are given in Chapter VI. of the Municipal Commissioner's report, comment on it here would be superfluous.

The hospitals in Bombay City which were either expressly set apart for, or, in addition to their ordinary patients, took in, the victims of plague number between 30 and 40. As a whole, they were well appointed, well managed, and successful. Chief amongst them must be mentioned the Arthur Road Hospital. This hospital is a permanent institution, and has been constantly open since plague began in 1896. It has a staff of over 100 all told, of whom 2 Medical Officers, 10 English Nurses, 6 local Nurses and 4 Hospital Assistants, form the superior

staff. The largest number of admissions was made in the week ending 11th March 1899, when 113 plague patients were admitted ; and on any one day, on the 10th March 1899, on which day 25 plague patients were admitted. The total number of deaths during the year in this hospital was 1,508, of which 1,161 were due to plague.

The following table, taken from the Municipal Commissioner's report gives the admissions from all causes with the deaths and recoveries for the year :—

	Admissions.	Deaths.	Recoveries.	Percentage of Mortality.
Plague	1,470	1,161	309	78·97
Relapsing Fever	1,436	311	1,125	21·65
Cholera	4	2	2	50·00
Small-pox	73	6	66	8·49
Chicken-pox	12	...	12	100·00
Measles	40	3	37	7·50
Whooping Cough	1	...	1	100·00
Observation and other Diseases ...	216	26	191	11·57
Total ...	3,252	1,509	1,743	46·37

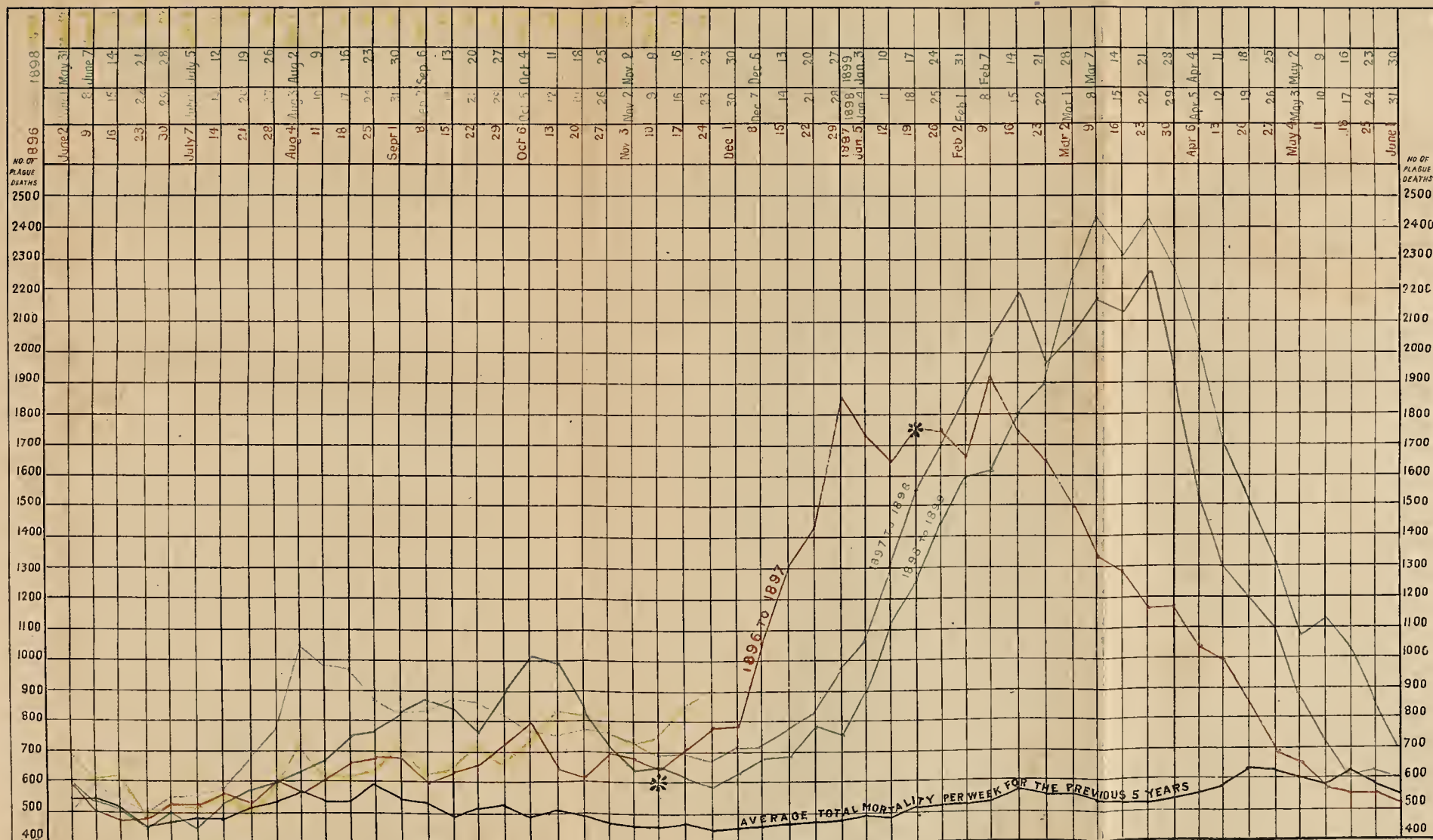
This hospital may be taken as the model on which the other hospitals either did or endeavoured to work. Dr. N. Chowksey was in charge of it throughout. Full details of all the hospitals are given in the Municipal Commissioner's report, Part VI. Lt.-Col. J. S. Wilkins, D. S. O., I. M. S., was in charge of all these hospitals from October 1893 to May 1899.

A chart showing the total mortality week by week for the three plague years is given overleaf.

BOMBAY CITY

Population 806,144.

Chart of The Weekly Total Mortality from Sept. 1896 to Nov. 1899.



NOTES { * * During this interval 400 000 people - about half the population, fled from the City
 { An exodus, though on a much smaller scale, also took place about the same time during the two following years

CHAPTER V.

SEA INSPECTION.

One of the most important measures adopted for the prevention of the spread of plague was the Medical Inspection of sea-going passengers and crews. In Bombay City both the export and import of plague infection had to be guarded against : export, first, when plague declared itself in Bombay, and import, afterwards, when Bombay itself being practically free from plague, people from other infected parts began to pour into the City. It will be convenient, therefore, to review the measures adopted for the prevention of exportation of plague separately from those instituted for the prevention of importation.

Outward Inspection.

For twelve years before the advent of the present plague epidemic in India, a perfect system of inspection of vessels, passengers and crews bound for Aden, Red Sea ports, Europe *viâ* the Canal, Persian Gulf and Mauritius, was in existence in Bombay for the detection of passengers or crews suffering from infectious or contagious disease.

In January 1897 it became clear that a panic-stricken population was fleeing from the City by all available routes, and was spreading plague to the inland towns as well as to the ports in the Bombay Presidency, more especially to those near the City. It was therefore absolutely necessary that all crews and passengers, leaving Bombay by sea, should be thoroughly and systematically examined, and all that was necessary was to extend the system mentioned in paragraph 2 to all crews and passengers on vessels and native craft leaving for any place or port *viâ* the Bombay Harbour.

On the 6th February 1897, therefore, rules were promulgated under the Epidemic Diseases Act (III. of 1897), which precluded the delivery of a Port clearance to any vessel without the production of the Port Health Officer's bill of health, certifying that the "master or person in charge, officers, crew and passengers (if any) of such vessel were free from any dangerous epidemic disease." Inspections had now to be simultaneously conducted at different centres in a very large harbour, at various places along an extensive foreshore and within wet docks, where tidal conditions had to be reckoned with. The prompt and successful carrying out of the enormous quantity of work involved the organization of a large staff of reliable and energetic Medical Officers and Subordinates.

The extended system of sea inspection came into force on the 6th of February 1897, and the following staff was made available for the work:---

Port Health Staff.

One Port Health Officer.

One Additional Port Health Officer.

Three Commissioned Medical Officers.

Three Assistant Surgeons.

One Hospital Assistant.

One Lady Doctor, and the services of a second as occasion required.

In addition to the foregoing staff, the Customs Department appointed—

Two qualified private practitioners.

One Lady Doctor, and later on a third private practitioner was entertained.

The Customs Medical Staff examined the crew and passengers of all native craft proceeding to ports between Karáchi on the North, and Bhatkal the southernmost port in the Bombay Presidency. The Customs Medical Staff was, however, supervised by the Port Health Officer.

It is due to the two local Shipping Companies—Messrs. Shepherd and Company and the British India Steam Navigation Company—which carried away the bulk of the fleeing population, to mention that they had already provided a Medical Inspection of their own.

Lieut.-Colonel F. F. MacCartie, C.I.E., I. M. S., Port Health Officer, during the first epidemic, thus describes the inspections:—

“The object aimed at being the prevention of the spread of plague to other Indian ports, to ports outside India, and, above all, to Europe, with its incalculable effects on Indian commerce, no measures were spared to obtain that end, and the most characteristic feature of the inspection became its extreme strictness and searching nature. Plague, moreover, is a disease which requires a very rigid and close inspection for its recognition. Its main and chiefest signs during the Bombay outbreak were fever and buboes, and all natives with either of these signs became objects of suspicion; their temperatures were taken and they were subjected to the most searching examination in private. During the months of February, March, and April, the number of persons placed on one side for temperature observation ranged from 20 to 25 per cent., and as many as a dozen rapid-registering thermometers were in use at the same time. It need hardly be said that to eliminate the suspicious cases a careful individual examination of each native was necessary, and this included not merely a look at a man's tongue and face, and pulse-observation, but a careful exploration of his body for glandular enlargement. Nor was the examination confined to the persons sailing on a vessel. The vessel itself was overhauled and a high sanitary condition insisted on. This included the opening and thorough cleansing of lascars' boxes, which were often found to contain filthy clothes and rubbish quite capable of supporting the plague microbe in comfort and affluence. In fact, it would be impossible, humanly speaking, to devise a more stringent or exhaustive examination for the prevention of the export of plague.”

It was no wonder, then, that when the Indian Delegate to the Venice Sanitary Convention, after close personal observation, described the measures in force in Bombay, his statement was received with “satisfaction mingled with incredulity.” Members of the Foreign Scientific Commissions that visited India to study the plague expressed their surprise and admiration at the completeness of the inspection system, and in the changed attitude of Europe—resulting from their favourable representation, is presumably to be found the reason for the relaxation of the severe quarantine in force at Brindisi, Marseilles, and other ports.

When the Venice Convention Regulations were published, it was found that they provided nothing essential that was not already in existence in Bombay. The Convention, however, ruled that the examination of all persons sailing on a ship was to be conducted on shore prior to embarkation. Arrangements were made, as soon as possible, to give effect to this recommendation, and the crew and passengers of all vessels, including native craft, bound to ports out of India, have been examined on shore prior to embarkation and conveyed on board under Police escort. The great majority of passengers for the Indian coast ports leave by the British India and Messrs. Shepherd and Company's coasting steamers, and they were examined on shore, prior to embarkation, in sheds specially arranged for the purpose, even before the Venice Convention came into force. As an additional precaution, the clothing and bedding of native crew and all 3rd class and deck passengers leaving for ports out of India are subjected to disinfection by means of saturated steam for 15 minutes at a pressure of 10 lbs. to the square inch. This pressure gives a temperature of 239 F., and is said to be capable of destroying the most resistant organisms yet isolated.

The following statement shows the number of outward bound vessels, passengers and crews examined, and the number of persons rejected during the periods from February to

May 1897, June 1897 to May 1898, and June 1898 to May 1891 ; and well demonstrates the magnitude of the inspection work carried out in Bombay :—

Period.	Number of vessels inspected.		Number of persons examined.		Number of persons rejected.	
	Square-rigged.	Native Craft.	Passengers.	Crew.	Passengers.	Crew.
February to May 1897	1,038	16,154	182,386	143,906	678	153
June 1897 to May 1898	2,488	48,730	355,409	458,462	10,635	687
June 1898 to May 1899	2,708	57,480	546,881	515,136	15,380	1,314
Total	6,234	122,364	1,084,676	1,117,504	26,693	2,154

At first, those that were rejected were simply turned back *en masse* into the City. Later on some were sent to hospital, others were detained at the Modikhana or Port Health Observation Camp, while a large number were only prevented from sailing, as they presented no declared symptoms or such as may have been due merely to temporary conditions and to plague. Of those whose movements could be traced or who were placed under observation, 42 were found to have developed plague up to 31st May 1897, 92 between June 1897 and May 1898, and 128 from June 1898 to May 1899.

During the period covered by this review, over 2½ years, and during which time Bombay City suffered from three virulent epidemics of plague and has not once been free since the commencement, seven ocean-going steamers were reported to have had a case of plague on board of each. The first case was that of a pilgrim, and occurred on board a pilgrim-ship in December 1896. The second was discovered on board a Military Transport in March 1897, the passengers of which were examined by and in accordance with arrangements made by the Military Authorities. Two cases were found on board P. and O. Liners in March 1898 on voyages between Bombay and Aden. They were Sea Post Office officials, and both recovered. The remaining three vessels were also P. and O. Liners. One had a fatal case—native fire-man—at Aden in July 1898, the second vessel had a fatal case—lascar—at Colombo in August 1898, and the third vessel a fatal case—native passenger—at Colombo in 1898. It has not been possible to ascertain accurately if many cases occurred among the millions of crew and passengers who left for coast ports near Bombay, but very few have been detected. The following statement shows the name of vessel, date of case, and the Port Health Officer at the time :—

Between December 1896 and December 1897. (Port Health Officer—Lieut.-Colonel F. F. MacCartie.)	{	1. S. S. "Pekin."—Left on 28th December 1896 ; two cases occurred between Bombay and Aden.
		2. S. S. "Dilwara."—Left on the 10th March 1897 ; two cases (one case occurred in the family of a man in whose compound plague had been prevalent before they left Bombay).
Between December 1897 and May 1898 ; and again between November 1898 and June 1899. (Port Health Officer—Major J. Crummin, V.C.)	{	3. S. S. "Shannon."—Left on 5th March 1898 ; one case—European Postal official—recovered on voyage from Bombay to Aden and back.
		4. S. S. "Clyde."—Left on 30th April 1898 ; one case—Native Postal official—recovered.
Between May 1898 and November 1898. (Port Health Officer—Capt. W. E. Jennings.)	{	5. S. S. "Carthage."—Left on 2nd July 1898 for Aden and Europe ; two cases, crew, one died, one recovered.
		6. S. S. "Ballarrat."—Left on 16th August 1898 for Colombo and China ; one case, crew, died.
		7. S. S. "Bengal."—Left on 11th October 1898—Colombo and China ; one case of passenger, died at Galle.

Whenever any of the crew or passengers, removed from a vessel bound for a foreign port, developed plague, the fact was communicated by telegraph to the authorities at the first port for which the vessel was bound. In the case of vessels bound for an Indian port, the fact was also notified to the next port of arrival.

Inward Inspection.

When the plague declined in Bombay City large numbers of people returned to Bombay as eagerly as they had left it. In the meanwhile, the infection had spread far and wide over the Presidency, and many of the places from which people returned were now in their turn active disseminators of plague. It was necessary therefore to protect Bombay as far as possible, and with that view inspection of inward passengers was commenced early in April 1897. All passengers coming from any place on the sea coast between Bhatkal on the south and a line ten miles north of Káráchi, or coming by vessels which touched at any intermediate port, were inspected under the direction of the Port Health Officer by an establishment of the strength shown below, provided by the Bombay Plague Committee:—

Three Commissioned Medical Officers.

Two Private Practitioners.

Five Assistant Surgeons.

Thirteen Medical Students.

One Lady Doctor.

One Lady Nurse.

One Lady Medical Student.

Passengers were disembarked at Modi Bandar, at the Docks' Harbour Walls, or at anchorages in the open harbour, except those coming by native craft, who were examined at the Dutiable and Free anchorages and at a special anchorage near Tucker's Beacon. At Modi Bandar and at the Docks the existing arrangements had to be augmented, and this was cheerfully done by Messrs. Shepherd & Co., including even an installation of electric lighting at Modi Bandar for the examination of passengers arriving after dark.

The manner in which the inspection was conducted during the first few months is thus described by Lieutenant-Colonel MacCartie:—

“In dealing with the masses of people who came under inspection during the four months, April to July, and who represented arrivals from heavily infected places, such as Káráchi, Janjira, Alibág, etc., as well as from ports where plague had not reached epidemic proportions, although each case was decided on its own merits, it was found necessary to decide on some defined plan in order to eliminate the healthy from the suspected. A sliding scale of temperatures was accordingly introduced, and passengers were divided into classes according to their own state of health and to the state of plague at the places which they were judged to have arrived from. A map showing the progress of the disease, and altered according to the reports from the mofussil, was furnished by the Plague Committee, and in accordance with the alterations in this map the figures on the sliding scale of temperatures would vary. Thus arrivals from a place only slightly infected would, if free from other signs of plague, and with temperatures under 100° F., be passed as healthy one week, and the next week, owing to unfavourable reports from the same place, would be placed in the observation camp if found with temperatures anything over normal. This system was found to work well, and as a brisk house-to-house visitation was being carried out by the Plague Committee at the same time, it is probable that few, if any, cases of plague which arrived by sea during the four months under report escaped detection, even if they succeeded in passing through the inspecting staffs in the harbour and at the bandars. Some difficulty was experienced in discovering the places from which the passengers had really come. By arrangement the tickets were not collected until the inspection was over, and in many cases tickets contained the information required. In other instances, however, the passengers had travelled on foot for many days and covered long distances in order to secure the cheaper transit by the Dharamtar ferry-boat, the fare for which by law is fixed at four annas, and their original places of departure could with difficulty be traced, and in some instances not at all.

“When the process of elimination was completed, the suspects were transferred to the Plague Committee’s Observation Camps, and detained there for periods varying from 3 to 5 and 8 days, according as they had come originally from uninfected, moderately and heavily infected places. Actual plague cases were sent in ambulances to a plague hospital.”

Such as it was then, such the inspection has remained up to the present time.

The extent of area from which passengers were examined was increased in August 1898, and Hongkong, Madagascar and Jeddha were added to the list; on the other hand, people arriving from non-infected and lightly infected ports on the coast were exempted from inspection from time to time. So also were changes made in the staff, especially when importation of plague into Bombay City was not a matter of much consequence, owing to an epidemic in the City, or when the whole of the inspections, outward and inward, were conducted by the Port Health Staff alone.

Pilgrims returning from Jeddha were isolated in the pilgrim shed until their kit was thoroughly disinfected, after which they were sent direct to their final destination and were not allowed to have any unnecessary communication with the City.

The following statement compares the number of arrivals inspected during the three epidemics:—

Period.	Number of vessels inspected.		Number of persons examined.		Number of persons segregated.	
	Square-rigged.	Native Craft.	Passengers	Crew.	Passengers.	Crew.
April and May 1897	422	8,072	167,173	62,911	5,324	...
June 1897 to May 1898	1,447	39,959	270,023	310,271	39,841	42
June 1898 to May 1899	522	830	83,135	35,356	281	5
Total	2,391	48,861	520,331	408,538	45,446	47

The Plague Committee’s Staff were dispensed with on the 21st April 1898, and the Customs Medical Staff were taken over by the Port Health Officer on 28th January 1899. Since the latter date the Port Health Staff have been responsible for all Medical Inspections in the Harbour.

During the period covered by this review, the total number of vessels, including native craft, examined was 179,850. They had 3,131,049 crew and passengers, and among them were discovered 409 cases of plague, including the cases found on the Harbour craft.

The sea medical inspection was, from the importance and magnitude of the interests involved by the spread of plague out of India, a source of the greatest anxiety to Government. But events have proved that no department of plague administration has been better managed; and the thoroughness and successful conduct of the operations as a whole has commanded warm admiration.

CHAPTER VI.

RAILWAY INSPECTION.

The adoption of measures for the prevention of the conveyance of plague infection by Railway Medical Inspection. Railway passengers engaged the attention of Government as early as October 1896, as soon as it was found that plague had become established, and was spreading in the Town and Island of Bombay. The authorities of the G. I. P. and B. B. & C. I. Railways were consulted as to the best method of securing adequate inspection arrangements, and before plans were developed, a telegram was received from the Government of India on the 12th October 1896, urging the adoption of a systematic examination of Railway passengers. Measures were soon organized for the systematic and careful examination of all passengers leaving Bombay by through trains at Grant Road on the B. B. & C. I. Railway line, and at Victoria Terminus on the G. I. P. Railway line, under Section 47 (*d*), 71 and 117 of the Railway Act (No. IX of 1890). Meanwhile active steps had been taken by local bodies in most of the important places in the Presidency for their own protection, and by the 22nd of October 1896 it was decided to make arrangements for the medical examination of arrivals at those places where it did not already exist. At about the same time Government were informed that the Southern Mahratta Railway Company had of their own accord instituted arrangements for the inspection of passengers travelling on their line at Poona, Miraj, Belgann, Londa, Hubli, Gadag, and Hotgi.

Soon after (about the middle of December) the large exodus from Bombay made it impossible for the then existing staff in Bombay to cope with the work. A better and more comprehensive system, to be worked by an adequate staff, was therefore introduced; and from the 4th of February 1897 Government decided to stop the inspection of through passengers in Bombay, and, instead, to provide for the examination of all passengers in down through trains at Kalyan and Palghar Stations on the G. I. P. and B. B. & C. I. Railway lines respectively, and to employ at each of these stations a large staff of Inspecting Medical officers under Commissioned Medical officers. Observation Camps and Plague Hospitals were rapidly erected at those places, and rules giving the powers for all necessary procedure were published on the 10th February 1897, under the Epidemic Diseases Act (Act III of 1897). These rules were shortly after applied also to Blusawal (for the protection of the Central Provinces, Bengal and Calcutta), to Ahmedabad (for the protection of Káthiáwár and Rájputána), to Hotgi (for the protection of the Southern Maratha Country, Hyderabad and Madras), and to Londa (for the protection of Goa, Mysore and Madras).

Inspection posts under these rules were subsequently established at various places in the Presidency, *e. g.*, Poona, Rajevadi, Dhond and Mannad, and the system of barrier inspections already in force for the inspection of arrivals at important places was improved and extended.

Under Government Resolutions No. 522—88-P., dated the 1st February 1897, and 1072—542-P., dated the 27th February 1897, Surgeon-Major (now Lieut.-Colonel) A. F. W. Street, D.S.O., I.M.S., Deputy Sanitary Commissioner, who had been placed on special duty in connection with the plague in January 1897, was appointed to control and supervise all measures for the Medical Inspection of passengers by railway, in and near Bombay, and at Dhond and Mannad and other stations in the Presidency. This control he exercised until the end of April 1897, when, in consequence of an accident, he was compelled to proceed to Europe on privilege leave. The control of the Mofussil inspections then passed into the hands of District Officers, while that of those in and near Bombay were made over by Government Resolution No. 2914—2994-P., dated the 27th May 1897, to Surgeon-Captain W. E. Jennings,

who supervised and controlled the measures in Bombay, until he was appointed in May 1898 to act as Health Officer of that Port.

In the Thana District, at the beginning of 1898, when medical inspection arrangements there gave way to the detention camp system, camps were opened at Bandra and Kalyan. These camps were placed in Surgeon-Major Street's charge from the 1st of February 1898 until the 6th April 1898, when they passed to the control of the Collector of Thana.

On the 23rd of February 1897, a list of infected areas was published and arrivals from such areas were compelled to furnish their names, addresses, business, &c., to the local authorities, who were thus able to maintain an efficient watch over them.

In April 1897 disinfection of the baggage of Railway passengers was instituted at Hotgi and Bhusawal. Later on, when plague had spread to several towns in the mofussil, and continued to spread, and it was found inexpedient to arrange for a wide-spread medical inspection so thorough as to influence its course materially, a number of Observation Camps were established in selected parts of the Presidency for the purpose of disinfecting and detaining for observation all third class passengers from infected areas.

In the meanwhile, Bombay became practically free, and, to prevent its re-infection, all passengers coming into Bombay City, whether by sea or rail or road, were examined, and such as came from infected areas and were likely to carry infection, including third class passengers by rail, were detained for observation in Camps. This arrangement lasted until the recrudescence of plague in December 1897.

To enforce detention of arrivals from infected areas was most difficult, because of the many methods by which it could be evaded. These methods of evasion, with the steps taken to obviate them, are shown in tabular form below:—

List of Local Stations on G. I. P. Line.	List of Local Stations on B. B. & C. I. Line.	Possible methods of evasion.	Steps taken to prevent evasion by these methods.
Infected area.	Infected area.	G. I. P. (I) Passengers from beyond Kalyan could book to Kalyan and re-book to Bombay in a local train.	(I) Booking to Bombay from Kalyan and Virar was stopped, except for season ticket-holders or those possessing certificates from Plague authorities allowing them to travel.
		B. B. & C. I. (I) Passengers from beyond Virar could book to Virar and re-book to Bombay by a local train.	
Kalyan.	Virar.	G. I. P. (II) Passengers could alight at Kalyan and walk to Mumbra, Diva, or Demauli, and book by a local train to Bombay.	(II) The Company stopped booking at these three stations, except for season ticket-holders.
Demauli.	Nalla Sopara	B. B. & C. I. (II) Passengers could alight at Virar and walk to some station south thereof and book to Bombay in local trains.	(II) The Company promised to report if the booking from stations south of Virar increased.
Divya.	Bhynder.	G. I. P. (III) Passengers could book to Thana and re-book from there to Bombay locals.	(III) Booking was stopped there, except for season ticket-holders or those who possessed certificates from Plague authorities allowing them to travel.
Mumbra.	Borivli.	B. B. & C. I. (III) Passengers could book to any stations between Virar and Bombay and then re-book to Bombay in locals, as some through trains stop at all stations.	(III) The Company consented to run all trains from beyond Virar through to Grant Road, and to stop all booking from north of Virar to any station south of Virar and north of Grant Road.
Thana.	Malad.		
Bhandup.	Goregaon.		
Ghât-Cooper.	Andheri.		

List of Local Stations on G. I. P. Line.	List of Local Stations on B. B. & C. I. Line.	Possible methods of evasion.	Steps taken to prevent evasion by these methods.
Kurla.	Santa Cruz Bandra.	G. I. P. (IV) Passengers could alight at Thana and walk to Bhandup, Ghât-Cooper or Kurla, and book to Bombay.	(IV) The Company would not stop booking from these stations, but promised to report if the booking became heavier so that steps could be taken later.
Mahim River.	Mahim River	B. B. & C. I. (IV) There is no station on the B. B. & C. I. Railway corresponding to Thana.	(IV) No steps necessary.
		G. I. P. (V) Passengers could book from the G. I. P. to the B. B. & C. I. line at Dadar and thus slip into Bombay.	(V) The Company stopped this.
		B. B. & C. I. (V) Passengers could book from the B. B. & C. I. to the G. I. P. line at Dadar and thus slip into Bombay.	(V) The Company stopped this.
Sion.	Mahim.	G. I. P. (VI) Passengers could book from stations north of Kalyan to stations between Kalyan and Thana or between Thana and Sion and change into local trains at Kalyan or Thana and thus slip into Bombay.	(VI) The Company stopped booking from stations north of Kalyan to Diva, Demauli, Mumbra, Bhaudup and Ghât-Cooper.
Matunga.	Dadar.	B. B. & C. I. (VI) Passengers could book from stations north of Virar to stations south and change into a local train at Virar and thus slip into Bombay.	(VI) The Company stopped such booking.
Parel.	Elph. Road.		
Currey Rd.	Parel.	G. I. P. (VII) Passengers could alight at Thana and walk to Sion Causeway.	(VII) This was obviated by instituting a system of detention of Causeway passengers.
Chinch-poogli.	Mahalakshmi.	B. B. & C. I. (VII) Passengers could alight at Virar and walk to Bandra Causeway.	
Byculla.			
Masjid.			
Victoria Terminus.	Grant Road.		

Local, through, barrier, frontier and mofussil inspections with disinfection Observation Camps, and other regulations to prevent infected or probably infected people from travelling, remained in force till after the middle of the year 1898, modified by local indications from time to time; as, however, there seemed little prospect of a speedy termination of the epidemic, and as it was considered that many of the regulations in force, such as detention and others, which practically close the channels of daily business, etc., were inexpedient as permanent features of plague administration, a modified system, known as the Surveillance System, was introduced in October 1898, which is laid down and described in Government Resolution No. 5772—5864-P. of 17th October 1898. The chief features of this new system were—

- (a) systematic and careful medical examination of each traveller;
- (b) careful disinfection of suspicious articles;
- (c) correct ascertainment and record of the location of travellers after they have been permitted to enter a town;
- (d) special regulations for travellers who could not be depended upon to give a trustworthy account of their residence and movements, or were suspicious, whether by reason of their appearance or symptoms, or the dirty condition of their clothes or effects.

On the 4th November 1898, Captain W. E. Jennings, I. M. S., was appointed Supervising Medical Officer, Railway Medical Inspection, to superintend the working of the new system in the Presidency proper. His duties, detailed at length in Government Resolution No. 6130—6228-P., dated the 8th November 1898, were briefly as follows, *viz.*:—

- (i) To report from time to time at what places medical examination should, in his opinion, be conducted and at what places discontinued;
- (ii) to be responsible for the efficiency of the examination at each place, for the arrangements for the comfort of the public, and generally for carrying out the provisions of Government Resolution No. 5772—5864-P., dated the 17th October 1898;
- (iii) to keep a list of infected stations for the purpose of special plague-marking of railway tickets; and
- (iv) to inspect Surveillance Registers at Railway stations.

It was of course intended that the decision regarding the stations at which from time to time examination should be held would depend on the course of the plague, and at the time when the new arrangements came into force, the state of plague in the Presidency necessitated the establishment of inspection and disinfection posts as follows:—

B. B. & C. I. Railway.

Palghar—Up and Down trains.

* Anand—Down trains.

G. I. P. Railway—(Calcutta Line).

Kalyan—Down trains.

* Manmad— do.

* Bhusawal— do.

Dhond and Manmad Railway.

* Manmad—Up and Down trains.

G. I. P. Railway—(Madras Line).

Kalyan—Down trains.

* Poona—Up and Down trains.

* Sholapur—Down trains.

Southern Maratha Railway.

* Poona—Up and Down trains.

Sátará Road—Down trains.

Belgaum— do.

* Hubli— do.

* Bagalkot—Up and Down trains.

Londa—All passengers alighting from the Southern Maratha Railway and all those travelling westward from Londa.

Under the revised system, local inspections for the protection of Bombay against Sálsette and *vice versá* were abolished, and Government decided to include the Islands of Sálsette and Bombay (which were both infected at the time) as one District, from which the conveyance of infection should be prevented by careful examination of through trains at selected places—Kalyán and Pálghar on the G. I. P. and B. B. & C. I. Railway lines, respectively, being the first two.

Note.—At the stations marked with an asterisk there was steam disinfecting apparatus, except at Bhusawal and Bagalkot, where disinfection was carried out by other means. The clothing, bedding and baggage of persons coming, or suspected of coming, from a plague-stricken neighbourhood, who were believed to be likely to convey infection, either from having lived with people among whom plague had been prevalent, or from the dirty condition of their clothing or baggage, were, at the discretion of the Medical Officer, liable to disinfection.

Note.—In the 14-30 daily Fast Poona Train, Poona passengers, who are locked into separate compartments, are not examined at Kalyan but at Poona.

During the month of January 1899, barrier inspection of all departures from Broach Station was instituted on the B. B. & C. I. line, and in March 1899 an inspection and disinfection post was instituted at Dohad on the Godhra-Rutlám line for the protection of Rájputána and Central India, and also a barrier inspection of all arrivals at Wathar on the Southern Maratha line for the protection of Wai, Panchgani and Máhábleshwar.

Since the 1st of May 1899 the following arrangements have been in force, *viz.* :—

I.—B. B. & C. I. Railway.

- i. *Dohad*—Inspection of passengers and local departures in down trains, and of passengers alighting from up and down trains. Disinfection by boiling.
- ii. *Bordi*—Inspection of local departures in down trains.
- iii. *Anas*—Inspection of local departures in down trains.
- iv. *Anand*—Inspection of passengers in down trains from Bombay, of local departures in down trains, and of arrivals and through passengers in up trains on the Godhra-Rutlám line. Disinfection by steam.
- v. *Broach*—Barrier inspection of local departures and arrivals. Disinfection by boiling.
- vi. *Pálghar*—Inspection of passengers and local departures in down trains.

II.—G. I. P. Railway.

- i. *Kalyán*—Inspection of passengers and local departures in all down trains from Bombay.
- ii. *Poona*—Inspection of passengers and local departures in all down trains from Bombay except the Madras Mail which is inspected at Sholápur. Inspection of all arrivals and through passengers in up trains on the Southern Maratha Railway. Disinfection by steam.
- iii. *Sholápur*—Barrier inspection of all arrivals by up and down trains, inspection of all through passengers and local departures in the down Madras Mail and in all up trains. Disinfection by steam.
- iv. *Manmad*—Inspection of all passengers alighting from down trains, from Bombay and Dhond.
- v. *Bhusáwal*—Inspection of all passengers and local departures in down trains. Disinfection by boiling pending the starting of steam disinfection.

III.—S. M. Railway.

- i. *Wáthár*—Inspection of arrivals in down trains.
- ii. *Sátára Road*—Inspection of all passengers and local departures in up and down trains.
- iii. *Londa*—Inspection of arrivals in up and down trains and through and local departures in trains towards Goa.
- iv. *Hubli*—Inspection of all passengers and local departures in up and down trains. Disinfection by steam.
- v. *Bagalkot*—Inspection of all passengers and local departures in up and down trains. Disinfection by boiling.

Though railway inspections have been in force for more than two years, yet the plague has spread. But, the area and duration of its prevalence considered, its dissemination has been very gradual: and there can be little doubt that it has been largely checked by this measure. The following causes have combined to discount its utility:—

(a) The impossibility, when the measures would have been most useful, of obtaining sufficient staff on account of the large demand made on the Medical Department for Plague, Famine, Cholera, and Frontier Campaigns, all at the same time, and the consequent delegation of inspection work to temporary medical subordinates; who, though doubtless equally zealous, were yet less qualified.

(b) Evasion by travellers, *i.e.*, alighting before arrival at, and walking past inspection-station; booking to intermediate non-infected stations, &c.

(c) The conveyance of infection by road.

(d) The impossibility of detecting cases in the incubation stage.

On the other hand there is much to demonstrate the value of the system as a preventive measure. Statistics go to illustrate that it is a powerful deterrent against those travelling, who are actually suffering from plague, and also against those travelling, who are probably infected: for out of many hundreds of thousands of passengers examined, only an infinitesimal number were found to be actually suffering from plague, and, out of many thousands detained for observation, a comparatively small number developed plague. It is almost certain that all actual plague cases, and all those who have commenced to sicken for plague, are detected, and only those incubating for plague escape.

The inspection establishments were made up of officers of the following classes, *viz.*, Commissioned Medical Officers, English Doctors and Lady Nurses, Government Assistant Surgeons and Hospital Assistants, Indian Medical graduates and native practitioners, medical students, Indian trained nurses and female inspectors specially instructed to assist in inspection work, and clerical, police and menial staff.

The following statement gives in a tabular form the period during which the Revised Regulations were in force, the number of passengers detained, the number of plague cases detected (and of deaths among them), the numbers of those disinfected and subjected to the clinical thermometer test, and the total expenditure at each station up to the week ending 2nd June 1899. It also contrasts in a general way the comparative efficiency of the Revised Regulations and the Detention Camp system (which was in force during the epidemic of 1897-98).

A comparison of the tables brings out the fact that under the Detention Camp system at 12 stations during an average period of 5·14 months each, out of 131,074, people detained (for ten days), 201 cases of plague were detected, and the total cost was over Rs. 1,85,000. Under the Revised Regulations at 14 stations during an average period of 5·7 months each, out of 19,302 people detained (for observation only), 413 cases of plague were detected, and the total cost was under Rs. 1,03,030, including cost of monsoon shelters for 1899.

Statement showing the work done under the Revised Regulation System published in Government Resolution No. 572
564 P., dated 17th October 1898,
and contrasting it generally with the Detention Camp System during the Epidemic of 1897-98.

REVISED REGULATION SYSTEM.										DETENTION CAMP SYSTEM.				
Camp.	Period under report.	Number of passengers detained.	Number of plague cases.	Number of plague deaths.	Number Disinfected.	Number subjected to Clinical Thermometer Test.	Total Cost up to 31st May 1899.	Rs. a. p.	Camp.	Period under report.	Number of passengers detained.	Number of plague cases.	Number of plague deaths.	Total Cost.
Poona ..	1st January 1899 to 2nd June 1899.	1,067	97	61	114,311	19,848	9,472 11 5	Rs. a. p.	Poona ..	19th January 1898 to 28th June 1898.	13,070	23	13	31,205 10 4
Kalyán ..	14th October 1898 to 2nd June 1899.	5,324	181	137	...	49,133	16,219 7 0		Kalyán ..	4 months ...	17,653	63	41	21,119 3 6
Manmad ..	1st November 1898 to 2nd June 1899.	707	1	1	26,679	37,632	13,397 2 1		Manmad ..	28th December 1897 to 18th May 1898.	12,968	10	7	30,917 0 0
Anand ..	14th October 1898 to 2nd June 1899.	3,065	64	30	31,000	25,892	13,894 1 0		Anand (including Wased and Mahi Cordon).	24th November 1887 to 30th May 1898.	59,726	79	53	50,225 12 5
Bhusawal ..	1st November 1898 to 2nd June 1899.	1,403	3	1	9,609	51,349	6,674 10 10		Bhusawal ...	5 months ...	3,494	1	1	5,444 5 4
Londa ..	18th November 1898 to 2nd June 1899.	386	2	1	...	2,234	1,000 4 8		Londa ...	5 months ...	4,534	...	...	4,000 0 0 (approximately)
Sátara Road ...	1st December 1898 to 2nd June 1899.	376	...	...	...	5,617	3,437 14 0		Kudeli ...	7 months ...	3,445	1	...	5,774 11 7
Sholápur ..	14th November 1898 to 2nd June 1899.	3,674	1	1	2,991	5,212	9,783 7 9		Nasik ...	10th February 1898 to 21st May 1898.	1,276	...	...	746 6 9
Bágálkot ..	16th November 1898 to 2nd June 1899.	99	5	3	5,382	13,168	4,885 10 1		Gadag ...	19th November 1897 to 15th June 1898.	2,509	...	...	2,076 11 5
Hubli ...	16th November 1899 to 2nd June 1899.	357	1	...	11,491	6,908	5,724 15 2		Igatpuri ...	15th February 1898 to 19th May 1898.	2,824	6	5	1,850 1 11
Belgaum ...	10th November 1898 to 30th April 1899.	994	4	...	...	4,642	4,564 1 3		Dharwar ...	15th November 1897 to 15th June 1898.	3,185	4	4	8,682 6 8
Pálgatár... ..	14th October 1898 to 2nd June 1899.	1,692	47	36	...	35,152	12,045 8 9		Bandra ...	13th January 1898 to 21st May 1898.	5,790	14	12	£3,000 0 0 (approximately)
Broach ...	15th January 1899 to 2nd June 1899.	4	2	...	310	71	532 11 1							
Dohad ...	1st February 1899 to 2nd June 1899.	154	5	4	1,439	4,637	1,351 4 10							
Totals, 14 Camps ...	Average of 5·7 month each Camp.	19,302	413	275	204,312	261,495	1,02,983 13 11		12 Camps ...	Average of 5·14 months each Camp.	131,074	201	136	1,85,122 5 11

CHAPTER VII.

THE NORTHERN DIVISION.

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AHMEDABAD DISTRICT.

Area	3,819 sq. miles.
Population in 1891	921,712.
Density of population	241 per sq. mile.
Rainfall	32.13 inches.

The Ahmedabad District is the most northerly District in the Presidency. It is bounded roughly as follows :—on the north by Deghám and Kadi (Baroda) ;
 Boundaries. on the east by the Gulf of Cambay ; on the south by Bhávnagar ;
 on the west by Kathiáwár.

During January and February a north-east wind blows which imparts a sensation of
 Climate and natural severe cold: from March a west wind, which becomes hot in the day-
 features. time, continues until the rains set in towards the end of June. The
 rains last through July, August and September. October is close and feverish ; and the cold
 weather sets in about the middle of November.

Towards the west the soil is black, towards the east, light. The District is well watered,
 and owing to the ill-defined channels of many of the rivers and the low level of the land on
 the lower part of the Sábarmati, large portions of it are periodically flooded.

Plague appears to have visited Ahmedabad District on several occasions ; and with
 Previous epidemics. great severity. The first outbreak of which there is any authentic
 record occurred in 1618. This epidemic began in the Punjáb in 1611, and no place in
 Hindustán was free from its ravages, which lasted, with intervals, for eight years.

Between 1683 and 1689 plague was again in Ahmedabad and remained for seven
 or eight years.

In 1770, a year of great famine, thousands of people died of fever in two or three days,
 so that none could be found to bury them.

But it was in 1812-13 that Ahmedabad suffered most severely. 1812 was also a year
 of famine, and plague appeared first in Cutch. Shortly after its appearance in Cutch
 “a contagion raged at Ahmedabad with a fury that can scarcely be believed” ; and half
 the population, about 50,000 persons, are said to have perished. This epidemic also lasted
 some eight years.*

With such a record the practical immunity of Ahmedabad is one of the most remarkable
 features of the outbreak which has now continued since September 1896.

A large number of imported cases occurred in this District from the beginning of
 October 1896 to the middle of June 1897, with a small number of indigenous cases.

Indigenous cases were discovered during the week ending 9th October 1896, at
 Ahmedabad, but from that date the District was free from indi-
 Plague in the Ahmedabad District, 1896-99. genous plague until the 19th February 1897. During that week
 a few such cases occurred at Ahmedabad, but the incipient outbreak was met with such
 promptness and energy that it was apparently at once subdued.

The Collector describes the steps taken—

“There have been eight indigenous plague cases in Ahmedabad. All the cases occurred
 in a square in the Railway suburb ; all the inhabitants were turned out as soon as the cases

* *Bombay Gazetteer*, Vol. IV.

were discovered; the sick taken to the isolation hospital, the healthy to a camp selected for the purpose, where huts were erected. The rooms in the square were all unroofed, disinfected, and whitewashed and fumigated; being built of brick it was not possible to burn them down."

Some 15 more cases occurred up to 7th May 1897, after which indigenous plague ceased.

Some of the indigenous cases occurred among persons who were segregated when the outbreak occurred, and who were apparently healthy when segregated. Had it not therefore been for the prompt action taken, it is possible that plague would have spread into the City.

As regards preventive measures, from the autumn of 1896 to the autumn of 1897, the most important measure was the medical inspection at the Ahmedabad Railway Station. After that, till the autumn of 1898, the district was also protected by, *inter alia*,—

- (1) The pass system, under which persons from infected areas could not go freely into non-infected areas by rail;
- (2) Observation Camps at Anand and Ahmedabad; and
- (3) Arrangements made to prevent persons from infected villages south of the Mahi River crossing the river to the uninfected areas on the north.

The observation camp at Ahmedabad still exists in a modified form, but the main reliance (besides medical inspection) is on the system for the surveillance of persons coming from infected areas.

The following table gives the total number of cases, month by month, throughout the District, from 3rd October 1896 to 30th September 1897, imported and indigenous plague being separately shown:—

Months.					IMPORTED.		INDIGENOUS.		TOTAL.	
					Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
October 1896	...	...	...	...	10	3	2	2	12	5
November "	...	...	...	...	...	...	...	...	...	...
December "	...	...	...	...	21	13	...	...	21	13
January 1897	...	...	...	...	39	27	...	...	39	27
February "	...	...	...	...	11	6	11	4	22	10
March "	...	...	...	...	15	14	9	7	24	21
April "	...	...	...	...	7	6	4	4	11	10
May "	...	...	...	...	5	3	2	1	7	4
June "	...	...	...	...	3	3	...	...	3	3
July "	...	...	...	...	...	...	...	...	...	...
August "	...	...	...	...	2	2	...	...	2	2
September "	...	...	...	...	...	...	...	...	...	...
Total ...					113	77	28	18	141	95

A few imported cases occurred at intervals throughout the following year, but from the 9th September 1898 to the 3rd of March 1899 neither imported nor indigenous plague was reported. A few isolated cases (12 cases—8 deaths in all) occurred during March and April 1899, but came to nothing. At the present time (September 1899) the Ahmedabad District continues free from plague.

BROACH DISTRICT.

Area	1463 sq. miles.
Population in 1891	341,490.
Density of population	233·42 per sq. mile.
Rainfall	30 inches.

The Broach District is bounded on the north by the Mahi river and the Gaekwar's territory ; on the east by the States of Baroda and Rájpipla ; on the south by the Surat District ; and on the west by the Gulf of Cambay.

Boundaries.

The lands of the District form an alluvial plain fifty-four miles in length from north to south, and sloping gently westward to the shore of the Gulf of Cambay. The climate of the District is as healthy as that of any part of Gujarát, and is much more pleasant than the climate of parts of the Province situated farther from the sea. In December, January and February, the mornings are sometimes bitterly chill, the thermometer showing a mean average minimum of 50°. Occasionally, however, the cold is much more severe. The latter days of March and the month of April are the hottest season of the year. Under canvas in the Wágá Sub-Division, the thermometer has been known to stand as high as 120°, and at this season, in every part of the District, even in well-built houses, the temperature occasionally rises to 110°.

The geological division of the soils of the District is into light soils and black soils. The light soil varies in character from the tract of consolidated sand-drift in the south of the District, to the heavier lands in the neighbourhood of the Narbada, almost merging into the richest alluvial loam. Though its rivers are the chief natural feature of the Broach plain, the height of their banks, up to which the whole country slopes, prevents the rivers from effectually carrying off the surplus waters of local floods.

Previous epidemics. There is no authentic record of plague in the Broach District previous to 1897.*

Although situated close to the infected territories of Baroda and Surat, the Broach District for a long time enjoyed a remarkable immunity from plague, which was secured by no advantages of natural situation or isolation, as it is easily approached both by land and sea. Broach itself is a busy town of over 40,000 inhabitants, maintaining constant communication with Bombay and other plague-stricken places. Imported cases of plague indeed could not but occur, but the number even of these was very small. Up to the end of March 1897, 18 such cases (12 in Broach Town) were discovered, but were not followed by any others for a long time. One more case was noticed in November 1897, 3 in January 1898, and one towards the end of March 1898.

Protective measures in the Broach District. December 1896.

To prevent the importation of infection into his District, Mr. R. E. Candy, I. C. S., the Collector, had devised a most careful system of inspection and observation of all arrivals. This system, simple in itself, was extended to all parts of the District, from the Broach Railway Station and seaport to the most obscure village on the frontier ; while the agency employed for this purpose was for the most part no more than the ordinary administrative establishment at the disposal of a Collector. Assistant and Deputy Collectors, as Chief Plague Authorities, retained supervision over Talukas, while groups of villages or observation posts were assigned to Awal Kárkúns, Abkári Inspectors, Hospital Assistants, and others. Observation Camps were established at important places in charge of compounders. Revenue

* *Bombay Gazetteer*, Vol. II.

subordinates, Police Patels, Village Police, Vartamias, Dheds and Bhangis were employed near their own homes on a small remuneration to patrol the whole of the frontier and to keep watch at "Nákas" or observation posts. "It must not be imagined," says the Collector, "that a 'Náka' was an elaborate expensive structure. Two or three village watchmen encamped under a tree, with a thorn hedge round a space which was kept clean for cooking and sleeping, and a lantern hung from a bough to give light during the night, constituted a 'Náka.' " Lectures on plague were delivered, pamphlets distributed, and children educated on the subject in schools. This was done with the double object of lessening the people's fear of, and of stimulating them to ward off, and, if necessary, combat, the disease. The Collector was unwilling to indent on the District Police except when absolutely necessary; and had recourse to Bailiffs of the Civil Courts, where work was then slack. Subordinates on plague duty were distinguished by a red rosette conspicuously worn. Meanwhile, every effort was made to avoid impeding trade and business.

First Epidemic. (April 1898—April 1899). By this means the District was most efficiently protected until April 1898, when indigenous plague appeared in Ankleshvar Town. The disease originated among the Ghánchis, a very dirty class, but how they caught the infection could not be discovered. Three successive deaths in one house within three days attracted notice, as mortality statistics were being registered with scrupulous accuracy throughout the District. The whole street in which these deaths occurred was at once inspected, and this resulted in the discovery of 2 more cases, which were at once removed to a Hospital. The inmates of neighbouring houses were sent to a Segregation Camp, the street disinfected, and the names of the inhabitants noted down, and they were medically examined twice a day. As a result, the progress of the epidemic was arrested, and from the beginning of April to the end of July 1898 only 4 more sporadic cases were registered.

But the people were by no means willing to acquiesce in these measures, and raised loud protests. Mr. Candy, the Collector, however, was equal to the occasion. He visited Ankleshvar, and calling a meeting of the Municipal Commissioners, he placed Khán Bahádur Sorábsháh Hormasji, District Deputy Collector, in the chair, while he himself addressed the meeting to such good purpose, that a determination to carry out plague measures spontaneously was immediately expressed. He thence visited the Hindu Segregation Camp, and, finding the inmates sullen and dissatisfied, he offered to have a Bráhmín brought for the purpose of reading the Shástrás to them, and to have a 'Tulsi' plant erected for their worship. The offer was gratefully accepted, and the people were happy and contented. The Mahomedans, too, were provided with a Mullah, who read the Korán to them. Nor were the children forgotten: for Mr. Candy presented them with various articles of amusement.

At length, however, in July 1898, plague again showed itself at Ankleshvar, and soon assumed epidemic form. The first victim was a Bania boy, who was attacked on the 13th of July; but the origin of the outbreak again eluded discovery. To quote the Collector's words—

"It is quite impossible to say how the plague microbe was introduced again; but as precautions were more or less relaxed owing to the rainy season, it is most probable that some one must have gone to an infected area and returned bringing the germs of the disease, or perhaps it is due to the vitality of germs which have lain dormant since April within Ankleshvar itself."

Prompt steps were taken to check the epidemic. As soon as the existence of plague was confirmed, 3 Hospitals were opened, for Hindus, Mahomedans, and Pársis respectively, and an Observation Camp for contacts in a Dharamshála maintained by local funds. Search

parties were instituted and disinfection of infected houses carried out. Nor was the sanitation of the Town forgotten; gangs of sweepers were appointed, under an Abkari Inspector, to clean up, remove dirt, etc.

The season was very unfavourable to evacuation; nevertheless, efforts were made in this direction. Three Health Camps were opened—one in a School-building, and the other two in ginning factories, which were kindly placed at the disposal of the Municipality by Messrs. Jamsetji N. Ginwala and Prágdás Dádábháí. The people were at first unwilling to leave their houses in the monsoon, but were gradually prevailed upon, by tact and persuasion, to occupy the Health Camps, and later to build their own huts. By the end of July those localities where the infection was worst had been vacated. But the plague showing no signs of abatement, it was resolved to push on complete evacuation, and by the 24th August the whole of the town lay empty, the people having removed either to the Health Camps or into huts erected by themselves round the town. Three weeks later the epidemic was brought under control.

Shortly after evacuation, the area occupied by the evicts was divided into 5 circles, each in charge of a Superintendent, who was provided with a small establishment. A muster of the people in each circle was called every morning; and the removal of corpses, without a proper certificate of the cause of death, being prohibited, the stealthy disposal of the dead became impossible.

It has been noticed above that plague was brought under control in September 1898. Thenceforth there was a steady subsidence, though the epidemic lingered on till the end of October. The following are the figures for the epidemic, month by month:—

Month.				Cases.	Deaths.	
(Date of first case, 13th July 1898.)						
July	1898,	3	weeks	...	19	10
August	"	4	"	...	162	112
September	"	5	"	...	134	105
October	"	4	"	...	5	9
November	"	1	week	...	2	2
(Date of last case, 3rd November 1898.)						
Total				...	322	238

The highest number of cases reported on any one day was 12 on the 10th August; and in any one week, 61 (week ending 12th August 1898).

ANKLESWAR TOWN
Population 10,692



The first village attacked was Kantiazil in the Hānsot Mahal. This is a small village of some 660 souls, and no less than 52 cases occurred here between 9th August 1898 and 3rd November 1898. It is described as a very healthy village situated on the sea-shore. The infection was traced to Bhagwa in the Olpād Táluka of the Surat District, separated from Kantiazil by the Kim river. Plague was raging there at the time, and there were some dealings between the people of the two villages. A Hospital and a Segregation Camp were erected and the village evacuated immediately. The last case occurred on the 3rd of November.

At this village inoculation played an important part : over 600 people—almost the entire population—being inoculated. There were 4 cases among those that were inoculated ; all proved fatal—the first 6 days, and the last 45 days, after inoculation. It is difficult to say whether the eradication of the plague was due to inoculation or evacuation, and both may fairly claim a share in the success.

From Ankleshvar the infection was carried to 13 villages of the Táluka, but it was speedily subdued everywhere, the largest number of cases in one village being 24 (in Diva), only two other villages returning over 8 cases. Evacuation was the rule—disinfection following in its wake.

It was unfortunately now the turn of Broach Town. Plague was decidedly on the wane in Ankleshvar, and the returns from the District were insignificant. Up to the middle of September 1898 it is probable that the vigorous protective measures, which, though similar to a great extent to those already described, were yet carried out far more efficiently in Broach Town, had kept the plague out of it. So successful were they that for a whole year there had not been an imported case. The credit for this the Collector ascribes chiefly to non-official agency :

“This immunity is due in my opinion to the personal character and exertions of Ráo Bahádur Chunilál Venílál, C.I.E. Knowing every street, and I might say, every person in Broach, and possessing the confidence of every one, he has exercised such a control that no one, though he secretly crept into Broach defying the regulations, could hope to escape detection. Hundreds of persons from Bombay, Surat, and Baroda would have liked to take shelter in Broach, but were prevented by the persuasive powers and stern determination of the Ráo Bahádur. He has shown a wonderful capacity for keeping people contented in spite of all the inconveniences to which they were put.”

But it would have been strange indeed had the capital of an affected District escaped scot-free. During the week ending the 16th September 1898, a case occurred in the Mahomedan quarter of the Town : this was followed by 10 cases in the following week. Some butchers from Ankleshvar are believed to have been responsible for its introduction. Rats do not appear to have played any part in spreading it. The following measures were adopted at once :—

“The whole quarter was searched by house-to-house inspection by the District Magistrate with the other European and Native Officers of the Station, but at the time no case of plague was found. * * * Subsequently the whole of the street has been evacuated, and all the houses have been disinfected. Sick persons have been removed to ‘Alai Bágh’s Plague Hospital,’ and the contacts have been segregated at ‘Shekh Matkat.’ The healthy persons of the locality have been removed to ‘Bava-rehen.’ Floors of the houses have been dug out and burnt, houses washed with lime, and their contents, such as furniture, etc., disinfected.”

During the week ending 30th September 1898, with a slight increase in the area of infection, 10 cases were again reported ; but thereafter the figures diminished, and only 17 cases occurred during the 10 succeeding weeks. Then, however, matters

took a turn for the worse, and the ‘D’ Ward, mostly inhabited by Mahomedans, was not only deeply infected with plague, but returned a high mortality from other causes. Evacuation of the infected localities and all insanitary and ill-ventilated mud-huts was now put in hand. Other localities too received due attention—for the Collector reports :

“ Rules 6, 6 A, and 6 B of the Mofussil Plague Rules have been applied to the whole of the City. Census of the whole city is being taken, and search parties have been instituted with a view to discover possibly concealed cases of plague. Every Plague Ward has been supplied with supervisors. As no corpse is now disposed of without a certificate from duly constituted medical authorities, there is no possibility of any death due to plague escaping notice. A circular letter has been addressed to all Medical Practitioners in the City to make a true diagnosis of every case of sickness coming under their treatment and give timely intimation to the authorities of any plague.”

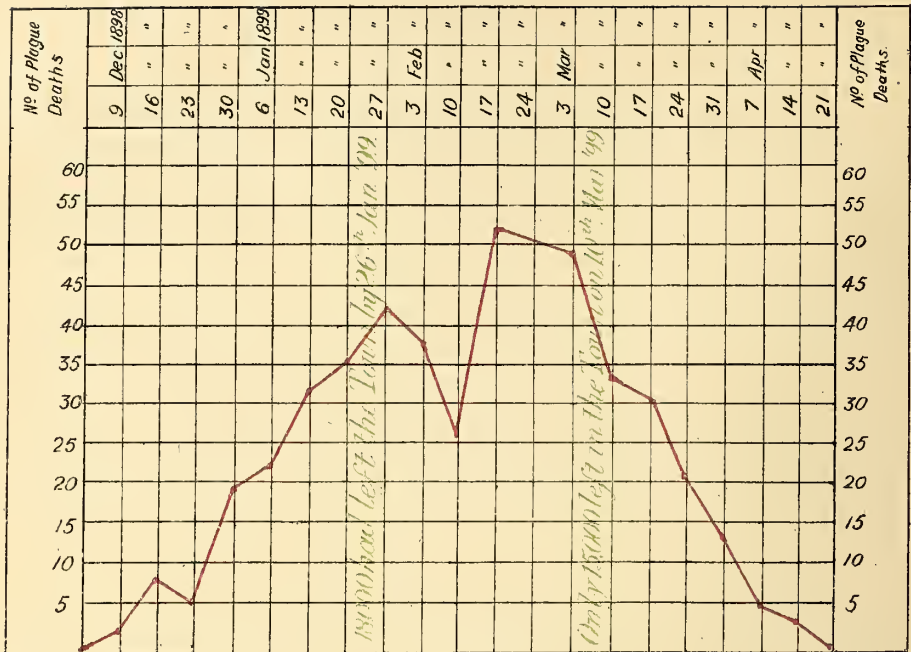
In spite of all efforts, the reported plague mortality, though rising, did not keep pace with the increased total mortality, and the Collector would not believe that plague did not claim the greater number of victims. Khán Bahádúr Sorábsháh, who had gained much experience in Ankleshvar, was appointed Personal Assistant to the Collector. Search parties were re-organized and non-official Ward Superintendents replaced by officials, and the staff of supervisors augmented. Next week the High School was closed, and the services of the staff utilized for plague work. Dr. E. Maynard took charge of operations in and around the town, and under his supervision disinfection work became more efficient. Captain G. P. Campbell, I. S. C., also arrived, and Dr. L. W. Richards and two Hospital Assistants were added to the medical staff. Lady Nurse Miss Mousely was deputed to examine female corpses.

Evacuation progressed slowly but surely, and a census of the Town, taken on the 26th of January 1899, disclosed the fact that the population was diminished by about 18,000. No attempt was made to collect the people that left the Town into large Camps, but they did not scatter very much, and control over them was possible. February 1899 was as bad as ever, and in the week ending 3rd March the highest figures, 68—49, were reached. Next week the population in the Town was only 15,500, and the attacks steadily decreased until the last indigenous attack was recorded in the week ending the 5th of May 1899. Inoculation was freely resorted to, both in the Town and in the District at large. The figures for the epidemic in Broach Town are compared below with the District totals :—

Month.	BROACH TOWN. Population—10,168.		BROACH DISTRICT (including Broach Town). Population— 341,490	
	Cases.	Deaths.	Cases.	Deaths.
<i>(Date of first case in Broach District, 13th July 1898.)</i>				
<i>(Date of first case in Broach Town, 14th September 1898.)</i>				
July 1898, 3 weeks	1	1	20	11
August " 4 "	1	1	169	118
September " 5 "	21	14	208	157
October " 4 "	7	5	73	50
November " 4 "	7	5	40	30
December " 5 "	39	34	51	45
January 1899, 4 "	156	131	165	138
February " 4 "	201	166	243	195
March " 5 "	180	147	273	197
April " 4 "	8	9	106	78
May " 4 "	1	1	42	28
<i>(Date of last case in Broach Town, 1st May 1899.)</i>				
<i>(Date of last in Broach District, 26th May 1899.)</i>				
Total	622	514	1,390	1,047

BROACH TOWN

Population 40,137.



The minor towns and villages were worst affected in March and April 1899; but there were not many of them. Immediate evacuation was possible, and no single place—except perhaps Tankária (pop. 3,064), which remained infected for about two months and a half, and returned 85 cases—contributed high figures or was long under infection.

At the time of writing (November 1899) plague in Broach District is slight; some 20 cases in all being returned weekly; the total figures for the year 1899, month by month, being as follows:—

Month.				Cases.	Deaths.
January	1899	...	...	166	139
February	"	...	...	244	196
March	"	...	...	274	198
April	"	...	...	106	78
May	"	...	...	42	28
June	"	...	...	...	1
July	"	...	...	78	46
August	"	...	...	134	98
September	"	...	...	131	88
October	"	...	...	19	20
November	"	...	...	1	...
TOTAL				1,195	892

KAIRA DISTRICT.

Area...	...	...	...	...	...	1,596 sq. miles.
Population in 1891	...	...	...	...	...	871,589.
Density of population	...	...	...	...	...	546.11 per sq. mile.
Rainfall	...	...	...	...	...	About 29 inches.

Separated from the head of the Gulf of Cambay by a narrow strip of territory, the District of Kaira, with a breadth varying from about twenty-five to forty miles, stretches towards the north-east for more than sixty miles along the right bank of the river Mahi. It is bounded on the north by Mahi Kántha and Ahmedabad; on the east, by the Panch Maháls; on the south and south-east, by Broach and the Gaekwar's territory; and on the west, by Cambay and Ahmedabad.

From November to March the air is pleasant and bracing. But even this lengthy season of cool weather fails to make up for the severe heat of the rest of the year, dry and parching in March, April, and May, moist and oppressive from June to October.

Except a small corner of hilly ground near its northern boundary, and in the south-east and south, where along the Mahi the surface is roughened and furrowed into deep ravines, the District of Kaira is one unbroken plain, sloping gently towards the south-west. The soils of the District are of four chief kinds, light, medium, black, and alluvial. The light is the prevailing soil, varying in quality from the loose grained yellow sand of the fields near the Sábarmati and the Mahi to a rich light-brown mould, common in the central subdivisions, and found to perfection in the south-west corner of Mátar. The District has two chief rivers: the Mahi, for nearly 100 miles its boundary to the east and south, and on the north-west the Sábarmati touching the District only for a few miles, but of great importance. Into it, along the channels of the Shedhi and Vátrak, the whole local drainage flows.

There is no previous history of plague in Kaira, cholera having been, so far as is known, the only great source of epidemic disease there.*

The Kaira District escaped all outbreak of indigenous plague up to the end of September 1898: although a large number of imported cases occurred prior to that date. The first of these imported cases occurred in December 1896. From that time to the end of May 1897, 18 more such cases (14 fatal) were reported. From May 1897 to May 1898, 76 more cases (57 fatal) were imported: from May 1898 to the end of September 1898 a further addition of 10 imported cases (6 fatal) took place:—

For period ending	Cases.	Deaths.	Remarks.
31st December 1896	1	1	} All imported.
31st May 1897	18	14	
31st May 1898	76	57	
30th September 1898	10	6	
Total	105	78	

It will be seen therefore that no less than 105 cases (78 fatal) had been imported into the Kaira District before the disease established itself : for, throughout this period of nearly two years, not a single indigenous case was reported.

The protective measures adopted on the District being threatened, at first few and on a small scale, but still thorough, grew with the increasing menace, until they culminated in the famous Anand Camp, Anand Cordon and Mahi Cordon. These will be treated in detail below.

On the occurrence of the first few imported cases (January 1897) a system of examination of passengers by rail was introduced ; the names and destinations of all passengers arriving from Bombay (then the only badly infected place) were registered ; the authorities at the destination of such passengers were informed ; and all such persons were watched, wherever they might go, for a period of eight days. Plague Authorities were appointed, and examination of arrivals took place at Kapadvanj, Matar Borsad and Mahudá. The Collector was also instructed (February 1897) to watch the total death-rate from *all* causes in the chief towns in his District.

Some four or five cases of plague, which occurred at Rutlam in August 1897, were reported to have come from Dakor ; but the most careful inquiries, made at Dakor by the Collector and the Civil Surgeon in person, failed to establish the existence of the disease there. The Collector arrived at Dakor on the 15th August, and instituted examination by a Medical Officer of all persons in houses in which deaths occurred ; the surveillance of all persons who arrived sick at Dakor ; and periodic visits by a Medical Officer to the 36 Sadhu Dharamshálas. Meanwhile, the Dakor pilgrimage was stopped.

The Anand Observation Camp was opened on the 24th November 1897. Mr. F. X. DeSouza, I. C. S., was placed in charge of it, with Assistant Surgeon Modi under him, to superintend the medical portion of the work. Captain Benn and Lieutenant Brand also joined the Camp Staff a little later, in order to superintend operations. The Camp was closed for detention purposes on the 17th May 1898 ; but it was continued as a Disinfection Camp for dirty persons arriving from infected localities.

The following classes were exempted from detention :—

- (i) Europeans.
- (ii) Government and Railway servants, and servants of a Native State travelling on duty.
- (iii) Holders of certificates arriving direct from an authorised Observation Camp.
- (iv) Persons holding passes notified by the Plague Commissioner as authorising exemption.
- (v) Persons travelling direct from uninfected localities.

At first only 'suspicious persons' were detained, but as the result was the escape of one or two cases of plague to Ahmedabad and Wadhwan, the rule was changed : all persons arriving from an infected place being treated as suspicious and accordingly detained.

Unfortunately this increased severity in the rule synchronised with a rush of panic-stricken people from Bombay (December 1897) : and the accommodation of the Camp was for the time being quite unequal to the demand made upon it. The work of building new huts was pushed on as rapidly as possible : people being detained during this period for two, four, or seven days according to circumstances ; the daily population of the Camp standing

at over 5,000 for nearly a month. It was not till the 18th January 1898 that ten days' detention could be generally re-introduced. As the panic in Bombay subsided, the traffic resumed its normal dimensions and the population of the Camp fell to 3,000, at which figure it remained for several weeks.

On the 9th February 1898 an entirely unexpected and heavy downpour of rain completely flooded the Camp and rendered its immediate dissolution imperative. About 3,000 persons were in detention: they were all despatched by special trains to Ahmedabad, and thence to their destinations, the authorities at these latter places having first been duly warned. Thanks to the dryness of the soil, the Camp soon became inhabitable again and was re-opened on the 11th February.

The site selected for the Camp was an admirable one. It was adjacent to the Railway Station. At one end stood the spacious Premchand Roychand dharamshála, offering accommodation for the office, and quarters for the superior class of travellers. On three sides stretched large open fields, rendering the Camp capable of almost indefinite expansion. The site was admirably suited for drainage, being on high ground cut off into sections by intervening *nálas*. It was far enough from the town to minimise the risk of infection being carried thither, but not too far for the convenient supply of provisions. The Camp covered about 60 acres of ground. It consisted of three main divisions entirely isolated from each other—the Detention Camp, the Segregation Camp, and the Hospital. The Hospital had two divisions carefully isolated from each other, one for the treatment of fever and other diseases, the other for plague. The accommodation of these divisions was as follows:—Detention Camp, 5,000: Segregation Camp, 400: Hospital, 30 (plague)—100 (other diseases).

In all sections of the Camp separate huts were assigned to Hindus, Mahomedans, Pársis, and low castes. First and second class passengers were allowed better accommodation than the rest. Every facility was given for families to consult their privacy by allowing them, so far as possible, to occupy a room by themselves. Unattended females were lodged in specially reserved huts.

Every section of the Camp was well supplied with water, of which the average daily consumption was about 15,000 gallons. Washing platforms and bathing enclosures for males and females were provided in every division of the Camp. There were three good wells in or close to the Camp premises; but as there were sporadic cases of cholera in Bombay, it was thought advisable to close these wells to the inmates. The more scrupulous among them, however, who objected to the use of pipe water, were supplied from the wells by specially entertained Brahmin water-bearers. The wells were regularly disinfected with permanganate of potash.

The Camp was studded with Banias' shops, where supplies of all kinds could be purchased at prices duly notified on boards placed outside the shops. Persons wishing to cook for themselves could do so in one of the cooking rooms erected for the use of the several castes. Cooking pots were supplied to those that had none. Persons not wishing to cook for themselves could board at one of the hotels—Hindu, Mahomedan, or Pársi, as the case might be, for four annas a day. The requirements of the better class of people were not lost sight of. Articles of luxury, such as tea, milk, fruit, and sweets, could always be had at the shops at moderate prices. Furniture, in the shape of country cots, tables, chairs, and benches, could also be hired on the premises. Test examinations of the food and provisions sold in the Camp were constantly made by one of the Hospital Assistants detailed for that duty.

At the commencement of the Camp the Banias from Anand ran the provision supply. But this course was open to more than one objection. There were too many of them for a

sufficiently close supervision ; there was reason to fear that some of them were in league with *badmashes* in the town, who made attempts, in one instance successfully, to commit thefts in Camp ; and coming as they did into daily contact with persons from infected localities, there was danger of their carrying infection into the town. To obviate these objections the contract was given to a contractor of Ahmedabad, who agreed to employ Ahmedabad salesmen only, and to compel them to live in the Camp. The experiment was highly successful. No more complaints were made about the quality of the provisions sold. Mr. Bhikhaji carried out his contract in the most loyal and honest spirit, although towards the end it must have been a losing concern.

Free rations at the rate of two annas per day were given to those who could not afford to pay for their food ; and sick persons received diet at the rate of four annas per day. The utmost caution had to be used in discriminating impostors from really needy persons. Rs. 2,335 were thus disbursed.

Every passenger on arrival was medically examined and had his name, caste, destination, place of departure, &c., posted up in a register at the gate. He was then disinfected and taken into Camp, where he was shown his hut. The huts were all serially numbered. A list was kept showing the names of the inmates of each hut. During their residence in Camp, the passengers were medically examined twice a day according to this list. A special staff of trained vaccinators and medical pupils was entertained for this purpose. Any one betraying symptoms of fever was promptly removed to hospital. If the fever developed into plague, all the occupants of the hut were re-disinfected and removed to the Segregation Camp, where they were subjected to a fresh period of ten days' detention, commencing from the last day of contact. If all went well, the *detenu* received his certificate of discharge on the tenth day. He was finally examined at departure, and the Medical Officer countersigned his pass in token of his being found healthy.

Perhaps the most important arrangements in connection with such Camps are those intended to prevent their evasion. The commonest device is, for travellers to alight at an earlier station and continue the journey on foot or re-book further on. Against this, effective precautions were adopted. Booking to Návli was stopped ; a subsidiary Camp was opened at Vásad. South of Vásad was the Mahi River, and if any one alight to the south of Vásad, his progress northwards by foot or rail was barred by the Mahi Cordon. It was thus impossible for travellers to give the slip to both Vásad and the Anand Camps.

Another common practice was for travellers from infected localities to alight at uninfected stations and re-book thence. This was prevented by insisting on a ten days' residence pass from all travellers from uninfected localities.

A special party of labourers known as the disinfecting party was employed under a *makaddam* in cleaning the inside of the huts of all refuse, etc. Once a week the straw was removed and sunned, and the floor was sprayed with a solution of perchloride of mercury. It was the duty of the disinfecting party, on the occurrence of a case of plague in the Camp, to dismantle the hut, to burn the walls and roof, and souse the floor and wooden framework with a solution of perchloride. The hut was not allowed to be re-occupied for a week.

The efforts made from time to time by private charity, to provide a higher standard of comfort for the inmates than would have been justifiable at public expense, deserve grateful mention. The stream of charity first began to flow from the better class of inmates themselves. In the early days of the Camp they raised subscriptions among themselves to the amount of Rs. 1,000, which were devoted to the purchase of bedding, blankets, cooking pots, etc., for the use of the poorer people. With the rise in the number of detentions the

flow of charity began to quicken. Generous persons from Bombay and Ahmedabad forwarded consignments of bedding, blankets, etc., for the use of the sick and the needy; and a munificent donation of over Rs. 3,000 worth of bedding and cooking pots, the joint gift of Sheths Mansukhbhai Bhagubhai and Mangaldas Girdhardas of Ahmedabad deserves special mention. Leaders of the several communities in the principal towns of Gujrát also made laudable efforts to soften the asperities of detention for their co-religionists. Of these, the arrangements made for the Pársis, at the instance of Sardár Davar Edalji Khursetji Modi of Surat, were conspicuous for their completeness.

By permission of the Postmaster-General, a Branch Post and Telegraph Office was opened inside the Camp. Letter-boxes were put up in every part of the Camp and cleared twice a day.

The strength of the Police force doing duty in the Camp varied from time to time. At its maximum it numbered one Chief Constable, 17 Non-Commissioned Officers, and 149 Constables. Of these, 59 were recruits, who were practically useless. At the time of the great rush from Bombay there were but 56 men, and more had to be telegraphed for. The Police force was employed as follows:—A small party was detailed to escort the passengers from the trains and keep order in the disinfection yard, and the rest were employed in forming a cordon of sentries round the Camp. With the help of the reserve, a system of night watches was stringently maintained and the streets were patrolled throughout all the hours of the night.

The following general remarks by Mr. DeSouza are interesting:—

“I do not think it can be disputed that the Camp has amply justified its existence. No case of plague has been allowed to escape north of Anand, and Gujrát has been kept free from infection. Seventy-eight cases of plague were intercepted. The number is considerable, but compared with the number of persons detained may seem disproportionate. It would be wrong, however, to measure the value of quarantine Camps by the number of cases intercepted. They perform even a more important function by deterring the sick and probably infected from travelling. Besides, it is by no means unlikely that a ten days' sojourn amidst the healthy surroundings of a Camp arrests the development of the disease in persons arriving infected. But still the fact remains that nearly sixty thousand persons had to be detained for the discovery of seventy-eight cases. The question naturally arises, whether the same results would not have been attained by subjecting a smaller number to detention.”

The Máhi River, running from east to west, effectively divides the Kaira District from Reva Kantha, Panch Mahals, Baroda Territory and Broach. When plague established itself in Baroda Territory, advantage was taken of the natural defence afforded by the river to prevent infection from crossing it and invading Kaira, as in that case the difficulty of stopping its spread to Ahmedabad, and thence to Northern India, would be greatly increased. With this view, as also with that of preventing evasion of the Anand Camp, Mr. F. S. P. Lely, I. C. S., Commissioner, Northern Division, organized a Cordon on the river for a length of 60 miles. To make it successful, the co-operation of the Baroda Authorities, a portion of whose territory lay beyond the river, and of the Cambay Darbár, was solicited and readily secured.

The arrangements made were briefly as follows:—

- (1) Nakas were posted at every ford and crossing, and all the ferries were stopped.
- (2) Supervisors were put in charge of every three or four Nakas, with orders to visit them constantly by day and night.
- (3) The Mamlatdars were directed to inspect the Nakas as frequently as possible, and other Government officials, such as Abkari Inspectors and Police Officers, were required to look up the Nakas while making their ordinary rounds.
- (4) Observation Camps were established at Wasad, Dakor, Thasra and Sevalia.

The Cordon was opened on the 1st January 1898, and its working entrusted to Rao Bahadur Bhimbhai Kirparam, Talukdari Settlement Officer, who brought with him from his own establishment a band of very active Bandar-karkuns. These, together with Talatis, especially deputed for the purpose, were appointed Supervisors, while the Nakedars were drawn from the village Rawanias and Dharalas specially engaged for the purpose. They were strengthened by a few Police at the more important crossings; and on the long shallow reaches, Sowars lent by the Cambay State by the Babi of Balasinor and by the Thakor of Sonipur were employed to patrol the posts. As the season advanced and the river grew shallower, the number of Nakas, and with them also that of Supervisors, had constantly to be increased.

The Nakedars and Supervisors were to allow no one to cross without special orders from Rao Bahadur Bhimbhai, and any one found to have crossed was taken to the nearest Observation Camp. Concessions were made only when absolutely necessary, and in such cases were made without regard to persons.

The Cordon was broken up on the 20th May 1898, after having accomplished its purpose very successfully, not a single case crossing the river.

First Epidemic (September 1898—May 1899).—After this long period of successful Umreth. endeavour to preserve the District from indigenous plague, Population—15,638. the village of Umreth at length succumbed, and reported 15 cases—8 deaths (all indigenous) during the week ending 30th September 1898; Saoli, a Baroda village, being responsible for its infection. The disease was at first confined to the Golas, who were all sent into Camp, the Golawad quarter being emptied; but the disease, thus checked amongst them, attacked those remaining in the village, which had ultimately to be completely evacuated.

To Umreth must be assigned the infection which subsequently spread to a large number of villages as far as Dakor on one side and Bhalaj on the other, although no effort was spared to prevent such a fatality. Plague also entered into the north of Thasra Taluka from the Panch Mahals villages across the Máhi. The weekly figures for Umreth are given below. It is easily seen how probable was dissemination with a village thus continuing to return cases week after week, from which there were doubtless many fugitives :—

Week ending					Umreth. Population—15 638.		REMARKS.
					Cases.	Deaths.	
30th September 1898	15	8	{ Amongst the Golas only. Golawad evacuated during first week of October.
7th October	"	...	...	...	7	8
14th	"	...	...	...	7	6
21st	"	4	6	{ People remaining in the village attacked. Evacuation of the whole village ordered and completed by about the middle of November. Exact date not known.
28th	"	...	...	...	6	5
4th November	"	...	...	...	15	12
11th	"	12	11	{ During this week, three other villages were attacked, reporting in all 23 cases—17 deaths.
18th	"	...	...	...	10	5
25th	"	...	...	...	7	7
2nd December	"	5	4	{ Two more villages attacked, making six in all: these six places reporting 68 cases—54 deaths between them.
9th	"	...	...	...	8	7
16th	"	1	1	{ Thirteen places reported 117 cases—71 deaths from indigenous plague.

The plague operations at Umreth and the surrounding villages were first placed in charge of Khan Bahadur Bahmanji Edulji Modi, District Deputy Collector. Although the plague lingered in Umreth for a considerable period after total evacuation, the comparatively small number of attacks and deaths, when the population of the town is considered, is a proof of the successful management of Mr. Modi and the officers under him. The lingering tale of two or three cases weekly was chiefly due to surreptitious visits paid by the people to their houses before they had been properly dealt with. On the 31st December 1898, for instance, 3 cases—2 deaths are reported from Umreth during the week. The Collector accounts for it:—

“In Umreth Town there were during the week 3 cases and 2 deaths. *These cases were all of persons who had gone back to their houses after evacuation.*”

Nor did Umreth cease to report its weekly case or two till the 17th February 1899 : since which date it has been free from plague. The following is the monthly plague mortality for Umreth Town from first to last :—

Month.					Cases.	Deaths.
September	1898	...	...	...	18	12
October	„	—4	weeks	...	21	21
November	„	—4	„	..	44	35
December	„	—5	„	..	22	18
January	1899	—4	„	...	6	6
February	„	—3	„	...	5	5
Total					116	97

The epidemic at Umreth was remarkable for two reasons—the small number of cases per week, which never in any week reached 20, and the lengthy period during which a few cases continued to occur. The infection of Umreth, slight though it was, from the menace it offered to Dakor Town, distant from it only some 4 miles, was a cause of grave anxiety.

Captain C. W. Somerset, I. S. C., 12th Bengal Infantry, took up the duties of Plague Officer on 29th December 1898, by which time the epidemic at Umreth itself was nearly over. The Collector remarks that no definite steps for re-occupation had, however, been taken. Disinfection and whitewashing had been stopped in December on the occurrence of two more cases among the Golas, and nothing further done. He continues :—

“Matters stood thus when after taking over charge of the District I visited Umreth in the beginning of February and was surprised to find that nobody made a move towards re-occupation, and meanwhile all business in the town was at a standstill. I learnt that the people objected to wholesale disinfection and limewashing, and that the municipal resources were exhausted and several months’ pay of the municipal establishment was in arrears.”

Ventilation only was therefore enforced ; holes being made in the roofs and walls of houses ; rooms which could not be reached by the sunlight being by such means disinfected. The houses were then left thus for a week exposed to sun and air, at the end of which period re-occupation was permitted. This work of exposure was supervised throughout by Captain Somerset, aided by a Head Karkun and two volunteers.

Besides Umreth, no less than 38 villages were attacked in the Anand Táluka, including Anand Town (pop. 9,214). The latter, however, was but slightly affected, reporting in all 59 indigenous cases—44 deaths, between the 10th February 1899 and the 26th May 1899 (including 2 cases—

1 death, which first occurred in the railway suburb about the 18th January). The first two cases were deliberately brought into the town by a couple of men living some way out of it, near the railway, and the details are reported by the Collector on the 13th February as follows :—

“The two cases at Ánand really occurred in some houses near the Railway which have been infected since some time. From here two men quietly went to live in the town, which is at a distance of $\frac{3}{4}$ of a mile : one of them died there, and the cause of death was given out as hydrophobia, but subsequent enquiries show it must have been plague. It has not, however, been included in the return. The other man was discovered ill soon after and died in the hospital, since the close of the week. Regarding these two as cases imported into the town, the latter cannot be regarded as yet as infected. However, the people have taken alarm and are rapidly evacuating the town and settling into the fields.”

Three cases occurring the following week, Ánand was completely evacuated : the town being empty by the 21st February. The weekly figures were as follows :—

17th Feb- ruary 1899.	24th Feb- ruary 1899.	3rd March 1899.	10th March 1899.	17th March 1899.	24th March 1899.	31st March 1899.	7th April 1899.	14th April 1899.	21st April 1899.	28th April 1899.	5th May 1899.	12th May 1899.	19th May 1899.	26th May 1899.															
3	3	1 *	..	1	2	3	2	4	3	6	5 †	1	2	1	...	5	1 ‡	8	9 §	6	5 ||	8	4	4	5 ¶	2	2	2	1 **

* Evacuated 21st February 1899. † Three villages newly infected : 2 adjoining Ánand. ‡ Due to people returning to dig up the floors of their houses which had been opened up ; this was stopped. § Re-occupation of town begun. || Nearly half of the town has been re-occupied. ¶ Re-occupation stopped. ** Date of last case—22nd May 1899.

The above notes furnish reasons for the prolonged series of sporadic cases in Ánand Town.

The following statement shows the places which suffered most severely in the Ánand Táluka :—

Town or Village.	Popula- tion.	Date of first case.	Date of last case.	Total number of cases.	Total number of deaths.
Umreth	15,698	26- 9-98	7-1-99	113	94
Ode	9,385	21-11-98	9-1-99	57	46
Sureli	2,330	22-11-98	14-1-99	59	53
Bhalej	4,002	10-12-98	12-1-99	48	40
Bhatpura	1,010	13-12-98	14-1-99	30	26
Ánand	9,214	10- 2-99	22-5-99	59	44
Navli	3,520	Not known, about end of February 1899.	About 10-4-99 ...	51	38

The Thásra Táluka suffered more severely than the Ánand Táluka, although a smaller number of places were infected—31 against 39. Of the places attacked, by far the most important was the town of Dakor, a Municipal town with a population of 9,487, but which attracts thousands of pilgrims from all parts of India (chiefly on every full-moon day), where great precautions were exercised and over which a careful watch was kept, owing to the suspicion of its immunity which had arisen in August 1898. It was not, however, till the 25th January 1899 that indigenous cases were found, the origin of infection being unknown. During the weeks ending 3rd February 1899 and 10th February 1899, Dakor reported 5 cases—2 deaths and 8 cases—6 deaths respectively. From this latter date evacuation of the infected streets was energeti-

cally carried out, but the following week's figures (20 cases—15 deaths) caused the Collector to order its complete evacuation, which was completed by the 21st February 1899. Thereafter the weekly figures were as follows :—

Week ending	24th February 1899.	3rd March 1899.	10th March 1899.	17th March 1899.	24th March 1899.	31st March 1899.	7th April 1899.	14th April 1899.	21st April 1899.	28th April 1899.
Dakor Town Population—9,487	12 7 *	9 7	10 8	16 11 †	15 13 ‡	1 2 §	2 2	1 ...	. 1	.. ...||

* Evacuation complete on 21st February 1899. † Rise due to people returning to the town to dig up the floors of their houses : this was stopped. ‡ The Collector is evidently not satisfied with the weekly figures, for he writes (28th April 1899) : " I am giving my personal attention to this town, and already there is an improvement." § Fall attributed by Collector to removal of 3 Camps to better sites. || Re-occupation permitted.

The places in the Thasra Táluka which suffered most severely are given in the following statement :—

Town or Village.	Popula- tion.	Date of first case.	Date of last case.	Total number of cases.	Total number of deaths.
Dakor	9,487	25- 1-99	... About 10-4-99	98	73
Kalsar	2,935	17-12-98	... 20-1-99...	54	47
Vanoti	1,715	3-12-98	... 17-1-99...	62	43
Dedamuwadi	174	8-12-98	... 16-1-99 ..	31	22
Kuni	1,652	About 23-12-98	... 2-1-99...	80	57
Menpura	543	10-1-99	... 20-2-99..	47	33

The town of Kapadvanj was found to be infected about the middle of February. Its population, according to the census of 1891, is 14,805, but it had an estimated population of over 17,000 at the end of December 1898.

Kapadvanj.
Population—14,805.

The ward system and other usual measures were in force, but there was insufficient supervision. At first only three streets were evacuated; others being emptied as the examination of the daily returns showed the occurrence of suspicious deaths. But in many cases the people left their streets voluntarily. Besides the Municipal Hospital, the Hindu Mahajans and the Borahs started their own private hospitals. For the former a philanthropic lady, Shetani Jadav, widow of Manilal Samaldas, gave a donation of Rs. 1,000. Later, to suit the convenience of the people camping out, temporary hospitals were opened in the fields at convenient centres. Without waiting for the abatement of the epidemic, working parties were set to work to ventilate all the houses in the infected localities on the same lines as before. This work was supervised in the beginning by Khán Sáheb Pherozechah J. Taleyarkhan, Acting Subordinate Judge. The immunity of the Borah streets is worthy of remark, as they are in close propinquity to the street first infected. The Borahs were not turned out of their houses, but were compelled to vacate the ground floors.

In the week ending 10th February one village in the Nadiád Táluka and one in Borsád, low down on the Máhi, were reported as infected. The Collector reports :—

"In the former case the infection had been carried from Thásra Táluka, in the latter from Baroda territory on the other side of the Mahi. Besides these villages themselves, I ordered the evacuation of some of those around Kanvadi. This had the effect of checking the spread of plague to the adjoining villages. When Dakor was infected, I similarly induced the people of the villages between it and Thásra to camp out, which they quietly did, so that with two exceptions they all escaped infection. These two exceptions were

Rasulpur-Thásra, where only 2 cases occurred, and Ekalyelu which had 3 cases and 3 deaths. This measure was, however, not pressed, if the people showed any unwillingness or where the villages could be continuously watched."

The attitude of the people was all that could be expected in such trying times ; and any opposition was overcome by persuasion. The following incident is related in this connection :—

"There was some discontent at first at Umreth regarding evacuation, but it was overcome by Mr. Modi's tact, sympathy and winning manners. In this connection I may mention an incident which is perhaps unique in the annals of plague. Advantage was taken of the practice of singing 'Garbas' on the night of the Manekthali Poonem (the last full moon of the Hindu year) to hold a mass gathering of the people of Umreth. A local poet, Bholanath Kadak, led the singing with a song relating to the plague measures of Government, in which the object of each was pithily explained and the townspeople were exhorted to place confidence in the Sarkár. The assembled multitudes repeated each line as the poet led, so that at the conclusion the people had pledged themselves to approve all that they had sung about. Mr. Modi then in a long speech explained the whole situation and methods. Thus in a single evening the people's prejudices were conquered. After that everything went on smoothly at Umreth, and what dissatisfaction remained was removed by my concessions in the matter of disinfection and limewashing."

The cost of plague operations is shown by the following figures which refer to infected Municipal Towns :—

Town.	Population.	Plague Expenditure.
		Rs.
Umreth	15,638	5,740
Kapadvanj	14,805	3,701
Dakor	9,487	3,449
Ode	9,385	1,775
Anand	9,214	1,543

Excluding the Anand Camp, which continued to be maintained by Government, the entire cost of plague measures in the District was defrayed by the Local Boards and Municipalities concerned, except the pay, etc., of the Special Plague Officer. The Municipalities of Umreth, Ode and Dakor were helped with a grant-in-aid of Rs. 10,000 by the District Local Board. The Dakor Municipality alone required an advance of Rs. 8,000 from Government, a large portion of which had been spent on preventive measures before the actual outbreak.

Looking now at the District as a whole, the two most striking points of the Kair epidemic are, (1) the large number of villages infected, (2) the small mortality from plague. Evacuation was the measure enforced throughout ; to it doubtless the small mortality is due. Each village, as it became infected, was at once evacuated, and the disease was checked *in that village*, but only to break out in fresh villages. This will be seen from the following table :—

Duration of Epidemic.	Total number of villages infected from first to last.	Largest number of villages simultaneously reporting indigenous plague.
From the 1st of October 1898 to the 31st of May 1899.	80	31 (week ending 10th March 1899).

The plague cases and deaths for the whole of the Kaira District (inclusive of every town) throughout the epidemic are given, month by month, below:—

Month.	Cases.	Deaths.
October 1898—4 weeks	21	21
November „ —4 „	95	55
December „ —5 „	335	282
January 1899—4 „	283	231
February „ —4 „	361	284
March „ —5 „	474	361
April „ —4 „	215	163
May „ —4 „	93	82
Total ..	1,877	1,479
Add—Imported plague in 1897 and 1898	105	78
Grand Total...	1,892	1,557

PANCH MAHALS.

Area	...	...	...	...	...	...	1,606 sq. miles.
Population in 1891	...	...	...	...	...	...	313,417.
Density of population	...	...	...	...	...	...	195·15 per sq. mile.
Rainfall	...	...	...	...	...	...	About 37 inches.

The five sub-divisions of the Panch Maháls, lying in the extreme east of Gujarát, form two groups separated by a hilly and forest-clad strip of the Báriya State, varying in breadth from about 9 miles in the north to 30 in the south. The western group, the larger of the two, comprises the sub-divisions of Godhra in the north, and Káloe, including the petty division of Hálol, in the south. Its boundaries are roughly as follows :—Kaira District on the north-west ; Lunáwára and Sunth States on the north ; Báriya on the east ; and Baroda on the south and west. The eastern group is composed of the Dáhod sub-division, with, in the north, the petty division of Jhálod. Báriya lies on the south-west and west, Lunáwára and Sunth on the north-west, the Meywár State of Kushalgad on the north and north-east, and the Málwa State of Jámbuga on the east and south-east.

In healthiness the climate varies greatly. Godhra, surrounded by large areas of forest and waste, though for residents fairly healthy, is rather a trying climate for strangers. The hot and rainy seasons weaken Europeans, and the cutting malarious winds and hot sun of the cold months are, to natives from other Districts, apt to bring on fevers of a dangerous type.

Within the limits of the District are great varieties of soil. In the north-west of Godhra, near the Máhi, is some alluvial land, south of this a beet of dull black, such as is found in Thásra, and beyond that a very large tract of light land. The District is well supplied with water from ponds and streams. The west is well supplied with ponds and reservoirs, of which five in Godhra and one in Kálol are unusually large.

There is no authentic record of plague in the Panch Maháls previous to 1896.*

Among the many phenomena enveloping the appearance and disappearance of plague in this Presidency during the past three years, one of the most remarkable is the complete immunity of the Panch Maháls District up to the end of 1898. Baroda Territory, which bounds it on the south and south-west, had suffered severely—the Kaira District, which bounds it on the west and north-west, had reported a large number of imported cases—and the Rewa Kántha Agency, which is intermingled with the Collectorate, had fallen—long before a single case of plague, either imported or indigenous, was reported from the Panch Maháls.

The precautionary measures enforced were the prevention, detention and observation of all arrivals from infected parts ; and the patrolling of the Baroda frontier (extending for some 70 miles) by Police, under the supervision of the Mámlatdár of Kálol. Doubtless these measures, energetically carried out as they were, were not without their effect. Doubtless, also, the famous Anand Detention Camp and Cordon did much to protect this District. But in the people's keen appreciation of the exigencies of the position, and in their loyal and hearty co-operation in enforcing the above precautions, must perhaps be sought the chief

* *Bombay Gazetteer*, Vol. III.

cause of the long security of the Panch Maháls. Such was the opinion of Mr. W. Doderet, I. C. S., the Collector, and it may be emphasized here:

“I must not omit to mention that our villagers grasped the necessity of avoiding all intercourse with Ratanpur, *and to this I mainly attribute their total immunity from contagion.*”

And it was the same all along the infected portions of the frontier; and when at length infection, crossing the border, entered the Panch Maháls, it came, apparently, as the consequence of disregarding this precaution. After the subsidence of plague in Baroda Territory (May 1898), these precautions were relaxed, and were replaced by the surveillance system.

First Epidemic (October 1898—April 1899).—The details of the first two cases of plague in the Panch Maháls are as follows:—

(1) A Hindu Wánia died on the 11th of September 1898 with suspicious symptoms. He was ill with fever for four days, and had a swelling in the groin and another behind the ear. The man was not treated by the Hospital Assistant during his illness, nor was any *post-mortem* held on the body. It may fairly be concluded that the man died of plague. The source of infection was never firmly established, as the man's previous movements were not known with any certainty, but ‘it was commonly reported in the Godhra Bazár,’ writes the Collector, ‘that the man had been to Sandhesal, a Gáekwári village, which is highly infected with plague.’

(2) The second case was discovered on the morning of the 12th September 1898. This case was a genuine plague case, and as the man admitted having visited a Gáekwári village within ten days previously, there is little room for doubt as to the source of infection in his case.

The Collector classes these two cases thus—

(1) Doubtful; (2) Imported.

Both these cases occurred in the village of Kálol; but as they were promptly isolated and all contacts segregated, it was not thought probable that the disease had really obtained a footing there. On the 2nd October 1898, however, a woman, who had not previously visited infected territory, succumbed to symptoms, which left no further doubt as to the existence of indigenous plague at Kálol. At the same time two or three suspicious cases also occurred, accompanied by the discovery of a number of dead rats. But no sooner was Kálol declared infected, than its inhabitants fled, panic-stricken, to the surrounding villages; and, although the inhabitants of these latter were wary in admitting them, they succeeded in spreading the infection throughout the Táluka. Kálol reported 60 cases—46 deaths up to the 2nd of December 1898, from which date it was free.

Kálol.
Population—4,464.

Godhra.
Population—14,691.

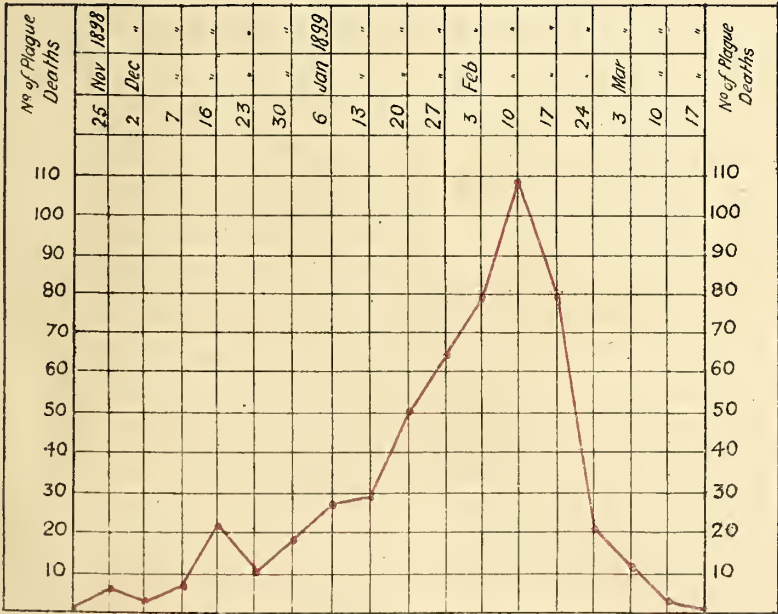
Although the danger to Godhra Town was recognized in good time, yet all efforts to prevent the importation of the disease into it from Kálol proved unavailing; and the circumstances attending its discovery there are of sufficient interest to merit narration in detail. The Civil Surgeon's suspicions having been aroused by noticing two corpses being carried past the Civil Hospital to the cremation ground, he enquired into the circumstances attending the death of the two persons, and was told that they were husband and wife, who had died of fever within half an hour of each other, after some three or four days' illness. Further enquiry elicited the fact that two of their children were also ailing from fever in the same house. These cases

proved on examination to be plague, and a search being made, two more cases were discovered close to the infected house. Altogether 8 cases and 6 deaths took place in Godhra during the week ending the 25th November 1898.

A special report was made by the Collector detailing the measures and the course of the epidemic in Godhra with reference to the efficacy of evacuation. This report was published in Government Resolution No. 2050-P., dated the 22nd March 1899. Complete evacuation was tried with a high degree of success: the following being the numbers of cases and deaths weekly:—

Week ending	Cases.	Deaths.	Total mortality.	REMARKS.
25th November 1898 ...	8	6	} 'Partial voluntary evacuation' only.
2nd December ,, ...	3	2	.. ..
9th ,, ,, ...	10	5	.....
16th ,, ,, ...	27	22	.....
23rd ,, ,, ...	18	10	.....
30th ,, ,, ...	28	19	.....
6th January 1899 ...	41	26	.....
13th ,, ,, ...	45	29	} Complete evacuation rapidly proceeding.
20th ,, ,, ...	59	50	.....
27th ,, ,, ...	107	64	176	} Evacuation complete from 6th February 1899.
3rd February ,, ...	106	79	223	
10th ,, ,, ...	125	108	164	
17th ,, ,, ...	137	78	95	
24th ,, ,, ...	28	22	34	
3rd March ,, ...	13	11	21	
10th ,, ,, ...	...	3	9
Total ...	755	534	722 (compared with 365 plague deaths for the same period).	

GODHRA TOWN
Population 4691



That concealment was practised to an abnormal extent during this epidemic is plain from a comparison of the "total" with the "plague" mortality for that period.

As regards the rest of the District, it has been noticed above that until plague established itself in Godhra Town, the only place infected was Kálol Town. With the increase of plague in Godhra, and the flight of the people, it gradually spread to other parts of the District, though the infection did not at any time assume a very severe form. Hálol Town (pop. 2,845) was stricken early in December, but the people rapidly vacated it, and but few cases were returned. The largest number of weekly cases returned up to the end of January 1899 was 22 in the week ending 27th January: but one newly infected village, Jantral (pop. 1,686), in the Kálol Táluka, was alone responsible for 18 of them. Here, too, prompt evacuation put an end to the epidemic.

Towards the middle of February 1899, when the epidemic was at its worst in Godhra, it was correspondingly bad in the villages: no fewer than 16 places returned indigenous cases, and in the week ending 24th February the largest number reported in a single week was reached, with 67 cases—40 deaths. Everywhere immediate evacuation was ordered, and it was invariably attended with success. At the beginning of April, plague disappeared from the District, and, except for a few sporadic cases in Dohad (pop. 10,947) towards the end of May 1899—due to infection caught while cleaning evacuated houses—the Panch Maháls District has continued free from plague.

The following table shows the monthly attacks and deaths in the Panch Maháls District, exclusive of Godhra, from the beginning of the epidemic :—

Month.	Cases.	Deaths.
October 1898	36	21
November „	18	19
December „	66	49
January 1899	44	32
February „	129	84
March „	133	96
April „	1	...
May „	6	3
June „ ... ..	...	...
July „ ... ..	...	...
August „ ... ..	...	...
Total	434	305

SURAT DISTRICT.

Area...	...	...	...	...	...	1,653 sq. miles.
Population in 1891	...	...	...	...	...	649,989.
Density of population	...	...	...	...	...	393.22 per sq. mile.
Rainfall	..	...	...	...	...	46 inches.

Situated on the shore of the Arabian Sea, where its waters begin to narrow into the Gulf of Cambay, the District of Surat stretches for about 80 miles from the Damanganga river northwards to the Kim. It is bounded roughly as follows :—On the north by the District of Broach and the Baroda State ; on the east by the Gaekwar's territory and the Dharampor State ; on the south by the Thána District and Daman ; and on the west by the Arabian Sea.

The District forms an alluvial plain stretching from north to south for about eighty miles, with a gradual fall sloping from the high lands in the east of the District westwards to the shores of the Arabian Sea. As regards climate, the District of Surat consists of two parts—one, of equable temperature, under the influence of the sea-breeze ; the other, beyond this influence, subject to changes in heat and cold almost as great as in the more northerly parts of the Presidency. Except in the neighbourhood of rivers, which, acting as channels, carry the sea-breeze further inland, its influence does not, as a general rule, extend for more than from eight to ten miles from the coast. Another peculiarity which helps to make the coast Districts more healthy than the inland parts, is their much lighter rainfall. Of the inland parts, in the opinion of the people of the District, Párdi in the south and Mándvi in the north-east are the most unhealthy.

The soils of the District, all more or less alluvial in character, belong to three chief classes—the black ; the light soil ; and the *besar*, a soil uniting the characteristics of the black and light varieties. The country is abundantly supplied with ponds, wells, and springs of water.

In the Dáng forests, by far the most unhealthy locality, remittent fever of a very severe and fatal type prevails up to the end of the month of March or April.

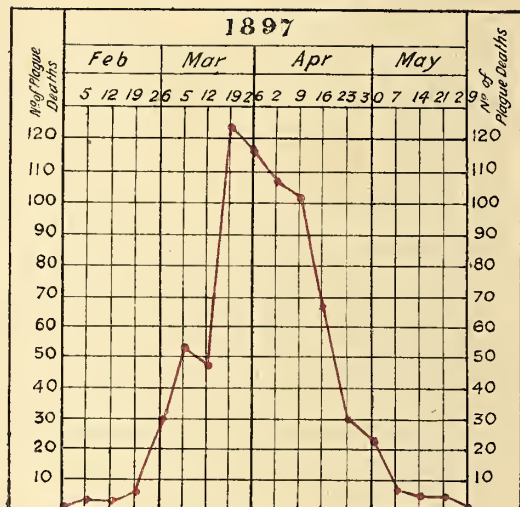
The first outbreak of plague in Surat was in 1684, and for six years it raged without interruption. But though during this time the city was never entirely free from the disease, at different seasons of the year the attacks varied in intensity. Lulling during the rainy months (June to September), the epidemic broke out with fresh fierceness in October, and again abating during the greater part of the cold and hot seasons raged with renewed fury towards the end of May. The death-rate at times “on a very modest calculation” amounted to 300 a day.*

First Epidemic (December 1896—June 1897).—The first epidemic in this District was a very mild one, although the town of Bulsár, where the disease first appeared, suffered somewhat severely. Magod (pop. 2,063) also suffered severely, reporting 281 cases—215 deaths. Surat City and Ránder Town were also slightly affected. The figures for this epidemic for the whole District were 2,049 cases—1,590 deaths. The epidemic lasted about six months : beginning in December 1896 and subsiding in June 1897.

The first case of plague in the town of Bulsár was that of a Hindu weaver of Bulsár who lived and worked in Bombay, but went to Bulsár on 22nd November 1896 and died on the same day. No other case was reported until a month later, when a grain-dealer arrived from Bombay and also died on the day of arrival. In the month of January 1897, 4 imported cases occurred, but indigenous plague was not discovered until February 7th, when a labourer, working in the grain merchants' quarter, succumbed to the disease. An epidemic then broke out: 942 cases—739 deaths being recorded in the Town, and 703 cases—522 deaths in the Táluka—over which the townspeople had scattered to seek refuge—up to the middle of June 1897. Of the District figures, 281 indigenous cases occurred in the village of Magod alone, and 109 in two other villages.

Period. Week ending	Cases.	Deaths.
Total up to 5th February 1897...	6	4
February 5th .....	...	1
" 12th	1	1
" 19th	15	6
" 26th	54	30
March 5th	62	54
" 12th	89	49
" 19th	128	124
" 26th	144	115
April 2nd	137	109
" 9th	143	102
" 16th	84	69
" 23rd	31	31
" 30th	26	24
Total up to 18th June ...	22	20
Total	942	739

BULSAR
Population 14,472



Surat City was infected from Bombay on the 8th December 1896. The first case of plague occurred in a Mahomedan boy, about 15 years of age, who was intercepted at the railway station by the Medical Inspector and brought to the Contagious Diseases Ward of the Civil Hospital on the 8th December 1896. He was a resident of Bombay, and lived at Khára Kuva. The boy had contracted the disease in Bombay. This was the first reported imported case. The last case was indigenous, and occurred on the 11th May 1897. Between the 8th December 1896 and 11th May 1897 (a period of about five months), in all 114 cases were reported, exclusive of 13 under observation, and subsequently discharged cured. Of the 114 cases, 49 were imported and 65 indigenous.

The only other important place affected during the first epidemic was the town of Ránder (population, 10,921), which reported 118 indigenous cases—102 deaths between the beginning of March and the end of June 1897.

Second Epidemic (August 1897—October 1898).—The second epidemic commenced in Surat City, and was remarkable for its duration—about 15 months. The virulence of the disease was never great, the figures were never large, but the District could not be cleared of plague. All the large Towns which had formerly suffered were attacked again: Bulsár becoming infected as the epidemics in the City and in Ránder came to a close. The number of places attacked in this epidemic was about 110; the total figures for the District being 5,493 cases—4,045 deaths.

The disease had apparently died out in April 1897, and from the beginning of May to the beginning of July, no case had been reported. On the 4th July 1897 a case occurred in the Nanpura Macchhiwad. The most careful inquiry failed to elicit any evidence as to its origin, and it must remain doubtful whether it was due to undiscovered cases, a recrudescence, or a fresh importation of the disease. A few sporadic cases occurred in July and August ; but it was not until the end of August that a serious increase, affecting the total mortality, took place, as will be seen from the table below :—

Month.				Population (Census of 1891).	Cases.	Deaths.	Total mortality.	Average mortality for previous 3 years.
June	1897	...	...	109,229	...	...	256	290
July	"	...	...		3	2	298	357
August	"	...	...		32	12	457	272
September	"	...	...		125	83	675	220
October	"	...	...		380	223	1,391	200

The week ending 22nd October 1897 showed a total mortality of 405, (or about 200 per mille, per annum), the highest on record for the City.

Up to that time the Civil Surgeon, Lieut.-Colonel K. S. Nariman, I. M. S., had been conducting house-to-house inspection ; but the Municipal Commissioners were now divided into search parties to assist him, each being accompanied by a medical man. At the same time, about the 20th August 1897, the following measures were adopted : disinfection, under the superintendence of the District Superintendent of Police and the Inspector, City Police, was carried out by gangs of firemen and coolies ; Hospitals, both public and private, general and caste, were opened, the Civil Surgeon superintending.

Evacuation, a measure which had in the previous epidemic proved so useful, and which was greatly relied on by the Collector, was almost impracticable. "The fact is," he reports, "the monsoon prevented my carrying out the measure I have found distinctly the most effective—the general evacuation of infected localities."

The spread of infection by rail was lessened by a pass system introduced on the 20th October 1897, which was worked by a Committee of 12 leading Native gentlemen, supervised by the Collector himself. Observation camps were appointed for persons unable to fulfil the conditions required by the passes.

On the 18th October 1897, His Excellency the Governor paid a visit to Surat, and held a public meeting in the Municipal Hall, at which he exhorted the people to assist the officials in combating the scourge. In spite of all efforts to prevent it, concealment was largely practised: "Patients are being moved from house to house and street to street," writes the Collector despondently, "carrying the plague germs with them." But in his opinion the objections to search parties outweigh the advantages, and he condemns them accordingly. "In my opinion, search parties do more harm than good, both because of the above-mentioned consideration (the removal of patients from house to house for concealment's sake) and because of the unreasoning terror with which they are viewed by the people."

On the 15th of October 1897, disinfection was handed over to Captain (now Major) T. E. Dyson, I. M. S., who greatly extended operations. Four native gentlemen were appointed to go round the City recording complaints against disinfecting gangs. Complaints, happily, were few, and in general easily redressed. Towards the end of October, at the close of the monsoon, three

Health Camps were established. These were occupied by inhabitants of infected streets, which were evacuated wholesale. Bamboos were supplied free to the poor, and huts built for the helpless. Twelve other private Health Camps were also built and occupied by people living even in uninfected localities. The number in these Camps on the 1st November 1897 was about 34,000. As a result of this, many lost their means of living; and the Collector started a General Relief Fund about the same date. This fund was generously supported, not only by contributors on the spot but by contributors in Bombay, Rajkot, and other places, and soon reached a total of some Rs. 22,000. Fuel was provided free.

On the 1st November 1897, Mr. A. Wingate, I.C.S., Plague Commissioner, visited Surat and approved of what had been done, and suggested the following additional measures which the Collector promptly put into execution: (1) The Ward System; (2) Segregation Camps for Contacts; (3) Extension of Hospital accommodation.

The Ward System came into force on the 3rd November 1897. The *modus operandi* was as follows:—The City was divided into 9 wards. Each ward was provided with a requisite staff of officials and non-officials, Police, a Clerk, and gangs of Coolies and Sweepers; each Superintendent being responsible for all the details of plague management in his ward.

Perchloride of mercury 1 in 1,000 was used as a disinfectant. When these Superintendents took over charge (3rd November 1897), Captain Dyson, assisted by Dr. E. Hill, assumed charge of the Health and Segregation Camps.

The Civil Hospital and the adjoining High School became a General Plague Hospital, and patients suffering from ordinary diseases were accommodated in another building. On the 3rd November matters stood thus—

Civil and Plague Hospitals...	...	...	Lieutenant-Colonel K. S. Nariman, I. M. S., Civil Surgeon.
Health and Segregation Camps	...	...	{ Captain T. E. Dyson, I. M. S. Dr. Ernest Hill, English Doctor.
Discovery of cases, removal of patients, disinfection of buildings and localities, and general sanitation.		{	Nine Ward Superintendents, each with an efficient staff, officials and volunteers.

The Collector speaks very highly of the Ward System. “The Ward System,” he writes, “had a speedy and marked effect on the plague. It first acted by immensely reducing concealment.” Prompt prosecution, doubtless, had a similar effect. About this time the power of granting Railway passes was given to Ward Superintendents.

In December 1897, the Collector made a permanent improvement in the sanitation of the City by having 7,000 pit privies filled in. This measure, he says, produced no active opposition and little grumbling. In many cases these pits were in the closest proximity to the household well used for drinking water.

Two incidents are mentioned at this time—

(1) In the Salabatpura Camp lived a sect called the Golás, or huskers of rice. They numbered about 5,000. They were allowed to go into the City during the day for work, returning to the Camp at night. When plague was at its height, the relatives and caste fellows of the Hindu patients often shrank from performing the last offices for their own dead, and a charitable Hindu gentleman (Mr. Dámódardás) supplied carts for the removal of corpses from the Hospitals. The Golás, however, were exceptional, and it was found that instead of doing their ordinary work, they hired themselves out as corpse-bearers in plague funerals. The result was an outbreak of plague in their Camp, which caused considerable trouble.

(2) In the beginning of December a rumour was spread in the City to the effect that the Collector had sent for European Troops from Deesa to oppress the inhabitants. This rumour, absurd and groundless though it was, nevertheless, produced a panic in the City; and it was necessary for the Collector to order the printing and distribution of a public proclamation throughout the City, stating that no European Troops had been, or would be, sent for, and that no locality would be evacuated without very good reason. Happily this proclamation produced the desired effect, the rumour dying as suddenly as it was born.

In January 1898, two new causes for anxiety arose. The first of these was an outbreak of the disease in the Private Camps. This, in itself a serious matter, had yet more serious results. Plague-stricken persons crawled back to their empty homes to die; and, after death, their corpses were thrown out into vacated streets by the neighbours, in order to avoid their own consequent impending segregation and disinfection.

These twelve Private Camps had hitherto been in the charge of the Plague Mámlatdár, in addition to his other work. As his work was now evidently excessive, they were handed over to Lieutenants C. W. Carey, R.A., and C. S. Fellows, I. S. C., two British Officers, who appeared on the scene on 27th December 1897. These two Officers, with an increased staff, soon reduced them to order; no light task, as they numbered 17,000 occupants. From the 28th December 1897, the twelve gates of the City were barred and guarded by the Police, egress and ingress between 8 P.M. and 6 A.M. being possible only on production of a special Pass.

The second cause of anxiety was a sudden influx of refugees from Bombay, where plague was raging. As Surat had previously derived infection from Bombay, the following measures were enforced to prevent its happening again :—

(1) Observation Camps were established at Surat and Bulsár on the 10th January 1898; others were gradually constructed and opened till, on 22nd February, Vapi, Udwáda, Párdi, Amálsad, and Kim were all similarly protected.

(2) Booking to Dungri, Sachin, Anroli and Sáyan (small railway stations in the neighbourhood of Surat and Bulsár) was stopped.

(3) Eight days' observation of people arriving in boats and ships from infected ports was imposed at all ports throughout the District.

(4) The Gáekwári authorities established detention Camps at Billimora, Navsári and Muroli.

(5) The Sachin State officials similarly protected Vedchha.

(6) An inoculation centre was established in the heart of the town, and lymph procured from Bombay; and Assistant Surgeon Manilál Desái, a popular and experienced Hindu official, of good caste, was detailed to superintend this work. Unfortunately there were no volunteers.

By these means the District, and the native territory included in it, were protected as efficiently as possible.

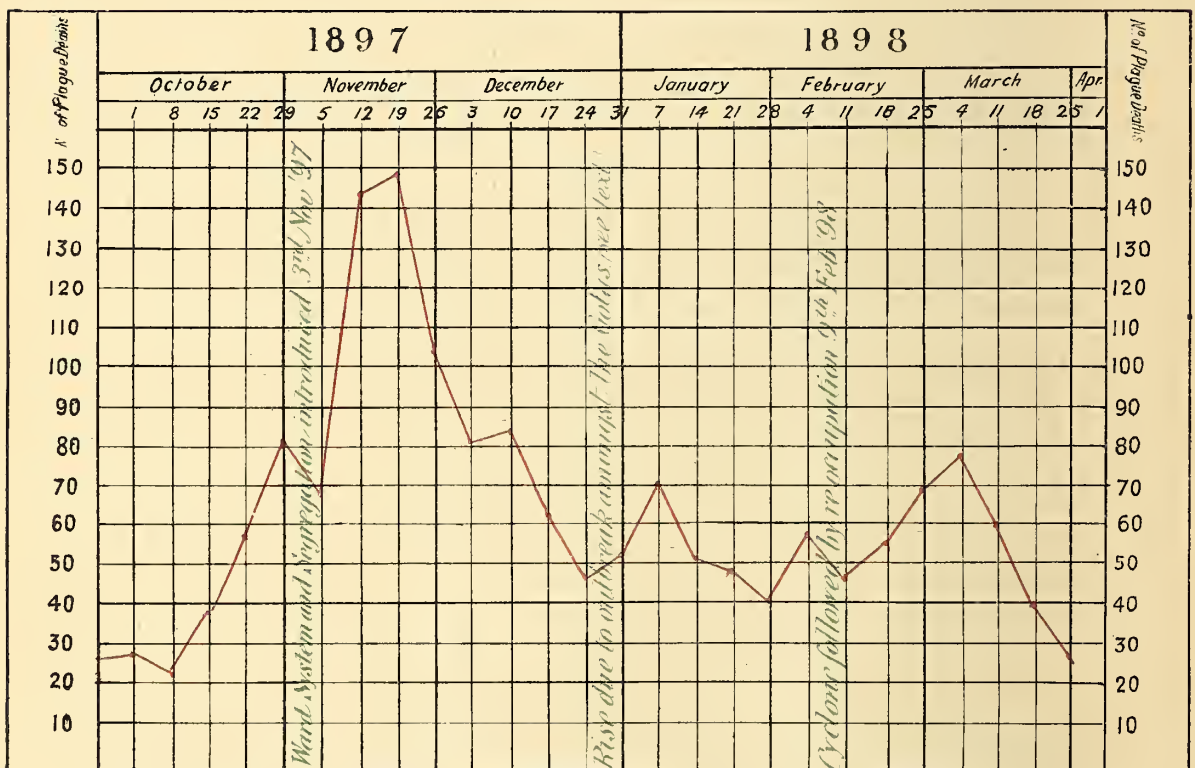
The plague gradually decreased up to the week ending 11th February 1898, when the total mortality was only 114, or some 30 above the probable average. Then came a misfortune. The following is the Collector's description of it :—

"The end seemed within sight when unexpectedly a cyclonic downfall of rain—most unusual at the season—occurred throughout the District on the 9th February 1898. The immediate and necessary result was the return of all the persons camped outside the City and the villages, to their houses. The ill-effects of this move," he continues, "were shown in the increased mortality of the next and following weeks."

Nor did the mortality of the City sink to the level it had reached just before the cyclone till the 18th March 1898—a period of five weeks.

Month.	Population (Census of 1891).	Cases.	Deaths.	Total mortality.	Average mortality for previous 3 years.
November 1897..	109,229	802	490	1,186	902
December " ...		385	274	770	242
January 1898 ...		301	238	660	279
February " ...		309	241	562	292
March " ...		188	194	449	280
April " ...		35	29	288	357
May " ..		2	...	232	411
Total...		2,022	1,466	4,147	295.71

SURAT TOWN.



Two of the Health Camps—Variáv and Majura—which had been the most sanitary, were re-opened on the 15th February 1898. That at Majura was reserved for Golás only—the most infected sect—and that at Variáv for all other castes.

A mutual pass system, for the benefit of traders of approved character and standing, was introduced by the Collectors of Surat and Broach on the 12th March 1898 on account of the impending Cotton season, in which both Districts were deeply concerned. On the 18th March, all "unauthorized" or private Health Camps were closed.

On the 30th April 1893, all restrictions on booking throughout the District were withdrawn, and on the 2nd May the last case of plague occurred. Since that date there have been but a few cases, mostly imported, in the City of Surat. This second City epidemic lasted 8 months.

Ránder was again attacked towards the middle of September 1897. The last indigenouse case had occurred here late in June 1897. Its vicinity to Surat, however, could not but expose it to infection, and it was not long before cases were discovered. Following closely on the epidemic in Surat City, the outbreak here terminated a little before it did at the capital of the District, lasting in a mild form for a prolonged period of 7 months. The following are the monthly figures:—

Ránder.
Population—10,921.

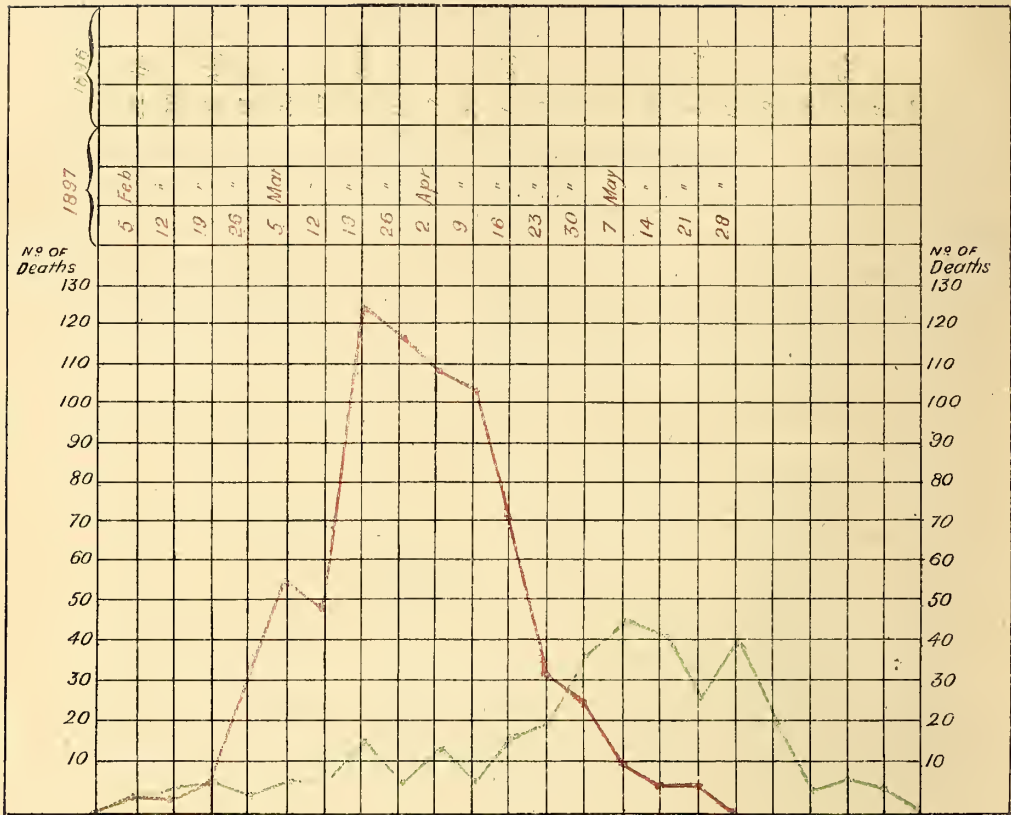
Month.					Cases.	Deaths.
September 1897,	3 weeks	...	...		10	10
October	" 4 "	...	...		11	9
November	" 4 "	...	...		17	13
December	" 5 "	...	...		22	18
January 1898,	4 "	...	...		37	30
February	" 4 "	...	...		76	56
March	" 4 "	...	...		38	40
April	" 3 "	...	...		17	16
Total ...					228	192

The District was making very fair progress, and great hopes were entertained that the disease had run its course ; but no sooner were Surat City and the Town of Ránder free, than the Town of Bulsár, which had been free ever since June 1897, though the rest of the Táluka was infected, had to be added to the list of infected places. Detention of new arrivals was being strictly enforced, and the town was thus successfully defended; but in the last week of April 1898, a Dhebra fish-seller, who had been to Billimora, stealthily entered the town at night on foot and infected his caste so suddenly that 9 cases occurred among them during the same week. The Tais (Mahomedan weavers), who lived side by side with the Dhebras, were speedily attacked, and the number went on increasing until it reached its maximum—62 cases, 41 deaths—in the week ending 12th August. Thenceforth there was a rapid decline, and in the last week of September there was no plague to speak of. The following table and chart show the progress of the epidemic:—

Bulsár Town.
Population—14,472.

Month,					Cases.	Deaths.
April 1898,	1 week	...	...		10	4
May	" 4 weeks	...	...		53	20
June	" 4 "	...	...		68	41
July	" 5 "	...	...		232	164
August	" 4 "	...	...		146	104
September	" 4 "	...	...		20	14
Total ...					529	347

BULSAR
Pop: 14,472.



The epidemic spread generally throughout the whole District, with more or less severity, and attacked also the State of Sachin. Bárdoli Táluka, however, was practically, and Mándvi quite, free, and so also were the States of Dharampur and Bánsda.

The measures adopted outside the City were for the most part evacuation of infected hamlets or villages, and observation of new arrivals, strictly enforced by village Pátels under stringent orders from the Collector, except in the case of those that visited infected places on business. Disinfection was secured by untiling the roofs of houses and leaving doors and windows open, though barred with bamboos to prevent ingress. Property of all kinds was exposed to the sun. During the second epidemic, the use of disinfectants was forbidden except in Surat and Bulsár, as it was considered that such disinfection was of no avail without skilled supervision. When cases occurred in the huts where the people temporarily put up in the fields, the occupants generally left the patient in the hut with an attendant, and of their own accord moved into other quarters. The Damaun Cordon effectually prevented the importation of plague from Damann Territory, which was, and is, a constant menace to the Surat District. Re-occupation was generally allowed 15 days after the occurrence of the last case, and it very rarely happened that fresh cases subsequently occurred.

Third Epidemic (January 1899—June 1899).—Yet a third epidemic broke out in the current year. During the months of October, November and December 1898, there was hardly any plague in the District, except for a few stray cases here and there. But in the months of January and February 1899, the villages of Tithal and Bhadeli Jugalala among

others in the Bulsár Táluka, and in March, Umarsádi in the Párdi Táluka, returned high Plague figures. In April matters improved, and in the first week of May there were only 8 cases—2 of them imported; but the unfortunate village of Magod has again been attacked, though there is every hope that plague there will soon be brought under control.

The following are the figures, month by month, for the whole District during 1898:—

Month.	Cases.	Deaths.
January 1899, 4 weeks	38	23
February „ 4 „	152	102
March „ 5 „	154	104
April „ 4 „	53	37
May „ 4 „	80	65
June „ 1 week	4	4
Total ...	481	335

SACHIN STATE.

The course of plague in Dumas in the Sachin State may be appropriately noticed here. As a precautionary measure, early in the progress of the Surat epidemic, a check was placed on the road leading to Dumas and Bhimpur, and the use of all other roads and bye-paths forbidden.

These restrictions were not, however, enforced in the case of people taking fish to Surat for sale, and it was due to this probably that plague found its way to Dumas. This was treated as an object-lesson for the neighbouring village of Bhimpur, the villagers of which did not afterwards proceed into Surat, but stopped at the border and there transferred their fish to Surat fish-sellers. Side by side with this theory of the origin, however, must be placed a report to the effect that a case from Surat was smuggled into Dumas by boat, the shore being too extensive for the Preventive force to watch thoroughly. The first case was detected on the 1st January 1898, and the last on the 21st April: the total number between these dates being 160. Of these, 9 cases occurred in January, 88 in February, 55 in March, and 8 in April.

On the very day on which the first case was discovered, the affected portion of the village was evacuated, a Hospital was established, infected houses cleaned, ventilated and disinfected with their contents which were exposed to the sun. Next day it was notified that no corpse should be disposed of without the permission of the Hospital Assistant. The Koli and Macchhi houses were distributed among the village officers and certain leading men who volunteered for the work. All sickness was to be immediately reported. From the 27th January, 1898, the evacuation of the whole village was commenced. On the 8th and 9th February however, there were heavy showers of rain and the people got back into the village. After a week they were re-evicted as soon as a case occurred in a 'falia,' and shortly the whole of the fishermen and Kolis were turned out. Mr. P. J. Mead, I.C.S., the Administrator of the Sachin State, makes the following interesting remarks on the method of evacuation and segregation of contacts:—

“The population were turned out in long lines arranged in blocks. Every block was supervised by one man. For this purpose I employed the Taláti and the various school masters, and later on the Patel for the Kunbis and Pársis. The Patel had plenty of general work, and did it splendidly. My supervisors were instructed to see every single person and feel the heat of their bodies with the hand. They reported to me or to the Doctor. Not a single case escaped detection, and very few were not early reported on. A few Macchhis, who were turbulent, were suppressed, and the work went on with great smoothness.

“Before the village was evacuated, segregation sheds had been crected near the Hospital. These were never popular. After evacuation, segregation of contacts was for a time

left to the people as in other small villages, but as the plague mounted, I arranged sheds near the different blocks of mândvas (called Ward A, B, C, &c.), and there had contacts segregated in the sight of all, but in rigid seclusion enforced by a Police Guard. This worked very well."

These thorough measures, supplemented by the placing of watchmen on the Burial and Burning grounds, soon began to have an effect. It has to be borne in mind that more than three-fourths of the population—3,240—consisted of the fishermen and Koli classes, which have been peculiarly susceptible to plague in the Surat District.

At the present time (15th September 1899) plague still continues, but the numbers attacked during the year have been small. The characteristics of the disease in this District have been persistent duration and small virulence: the largest numbers for any one week being 80 cases—69 deaths (week ending 25th August 1899), and the total figures for the whole year up to 15th September 1899, returned from 33 places, 1,179 cases—866 deaths.

THANA DISTRICT.

Area	...	...	...	...	...	...	...	...	3,578 sq. miles.
Population in 1891	...	...	...	...	...	...	...	...	819,580.
Density of population	...	...	...	...	...	...	...	...	229 per sq. mile.
Rainfall	...	...	...	...	...	...	...	...	102 inches.

The Thána District is bounded roughly as follows :—On the north, by the Portuguese territory of Damann, and the Kálu and Damanganga rivers ; on the east, by the Násik and Ahmednagar Districts ; on the south-east and south, by the Kolába and Poona Districts ; and on the west, by the Arabian Sea.

The climate, like the climate of the rest of the Konkan, is exceedingly moist for fully half the year, the rainfall being very great and often beginning in May. The low level of the plains of the district, its heavy rainfall, and the large area of salt marsh, forests, and rice-fields, make the climate hot, damp, and feverish.

The most feverish months are October, November, and December, when, after the south-west monsoon is over and under a powerful sun, decaying vegetable matter produces a malarial atmosphere. Hot springs are found in four sub-divisions,—Máhim, Vada, Bhiwndi, and Bassein.

The water of the spring which rises in the bed of the Surya river, and which is moderately hot and saltish, smells like rotten mud.

The main division of soils is into sweet and salt. Sweet land is either black or red ; the black called *shet*, that is the plain rice-fields, and the red called *mál varkas*, that is the flat tops and slopes of the trap hills, on which náchni, vari, and other coarse hill-grains are grown.

The low fields are the most productive, as the rain-water leaves a rich deposit.

In 1702 the plague broke out in the Island of Bombay, and carried off some hundreds of the natives and reduced the number of Europeans to the small number of 76 ; but there is no authentic record of plague in the Thána District proper previous to 1896.*

The City of Bombay forms, as it were, the starting point for the Thána District, which, while in ordinary times affording innumerable advantages to the population of the District, in time of plague becomes a steady and constant focus for the dissemination of infection. Every facility that can be contrived exists for the maintenance of the constant intercourse necessitated, and while the two Railway Companies vie with each other in improving the means of communication, numerous creeks admit entry into the innermost parts of the District to fishing boats and country-craft. The conveyance of plague infection from Bombay to Thána was therefore merely a question of time, although much was done in the way of preventing an outbreak by the prompt detection and isolation of imported cases at the railway stations and in municipal towns.

First Epidemic (December 1896—May 1897).—So far as can be discovered, the first indigenous cases occurred early in December 1896, though imported plague was detected

* *Bombay Gazetteer*, Vol. XIII.

as early as the first week of October 1896. Bándra, which is practically a suburb of Bombay, was the first to suffer, and contributed the largest number of cases; while Bhiwndi, Kurla (another suburb), Bassein, Bháyndar, Thána, &c., followed it in rapid succession. Until February 1897 measures for the suppression of the plague were in the hands of the Municipalities, and for one reason or another proved inadequate. On the passing of the Epidemic Diseases Act, however, "it was resolved," says Mr. A. C. Logan, I. C. S., the then Collector, "that the segregation of the sick and of their families in hospitals and quarantine camps should be rigorously enforced as essential to the suppression of the epidemic, and orders for the erection of the necessary hospitals and sheds in each affected place were given. The affected area was partitioned out among the available European officers: the Civil Surgeon took Thána, the Deputy Sanitary Commissioner Kurla, the First Assistant took the infected villages of Sálsette, and the Second Assistant those of Bassein and Dáhánu, while Mr. Gilbert gallantly volunteered to take Bándra, and I myself took Bhiwndi to assist the District Deputy Collector in charge." The activity displayed by these officers soon compensated for the inertness previously shown, and, what with the removal of the sick to hospitals or isolated huts, the evacuation of infected houses and their disinfection, the inspection of arrivals and departures, and general improvement in sanitary conditions, plague declined everywhere in April, and, with the exception of 2 or 3 places, disappeared everywhere by the end of May 1897.

The following statement compares the number of cases and deaths during the first epidemic at the principal towns with other places in the rest of the District:—

Place.	Population.	Cases.	Deaths.	Percentage of cases to population.	Remarks.
Bándra...	18,759	937	797	4.99	59 towns and villages attacked in all.
Bassein ...	11,291	497	377	4.22	
Kurla ...	11,469	495	430	4.31	
Bhiwndi ...	14,387	485	430	3.37	
Chinchni ...	4,785	329	266	6.85	
Vesáva ...	4,747	216	205	4.55	
Thána...	17,455	189	118	1.08	
Rest of the District ...	736,074	1,483	1,152	.20	
Total ...	819,967	4,631	3,775	.56	

It is noteworthy that of the 59 places which reported indigenous cases, 27 were in Sálsette, 22 in Bassein, 5 in Máhim, 3 in Bhiwndi, and 1 each in Kályán and Dáhánu Tálukas—a striking instance of plague having adhered to the Railway line and practically confined itself to the area traversed by the local trains from Bombay, the limits of which are Virár and Kalyán.

Second Epidemic (August 1897—June 1898).—During the month of June 1897 there were only 53 cases and 33 deaths: in July the District was quite free: but on the 13th of August Kalyán was stricken, and this proved to be the beginning of a second epidemic in the District. The first case at Kalyán was that of a Mahomedan merchant who frequently used to travel to Bombay. The case was concealed for several days, but eventually brought to light by private information. The disease then spread rapidly in the Mahomedan quarters

Kalyán.
Population—11,685.

of the town and in its neighbourhood. Within a fortnight the cases had risen to 18, and in the first week of September there were 19 cases—15 deaths. The disease was met by the segregation of the sick and the contacts, and disinfection of infected houses, but as the number of attacks was not reduced, it was resolved to evacuate several houses at a time: this had the desired effect, a steady reduction of attacks being noticeable. At the end of October this part of the town was entirely free, but the Brahmin quarter was attacked in November. The disease, however, was not virulent, and the largest number of cases in a week was 5. The final case was registered in the last week of the year 1897, and the total number of cases during the epidemic was 136 and of deaths 112.

The severe outbreak at Bassein during the first epidemic had ceased in June 1897, the last case having been registered on the 9th of that month.

Bassein,
Population—11,261.

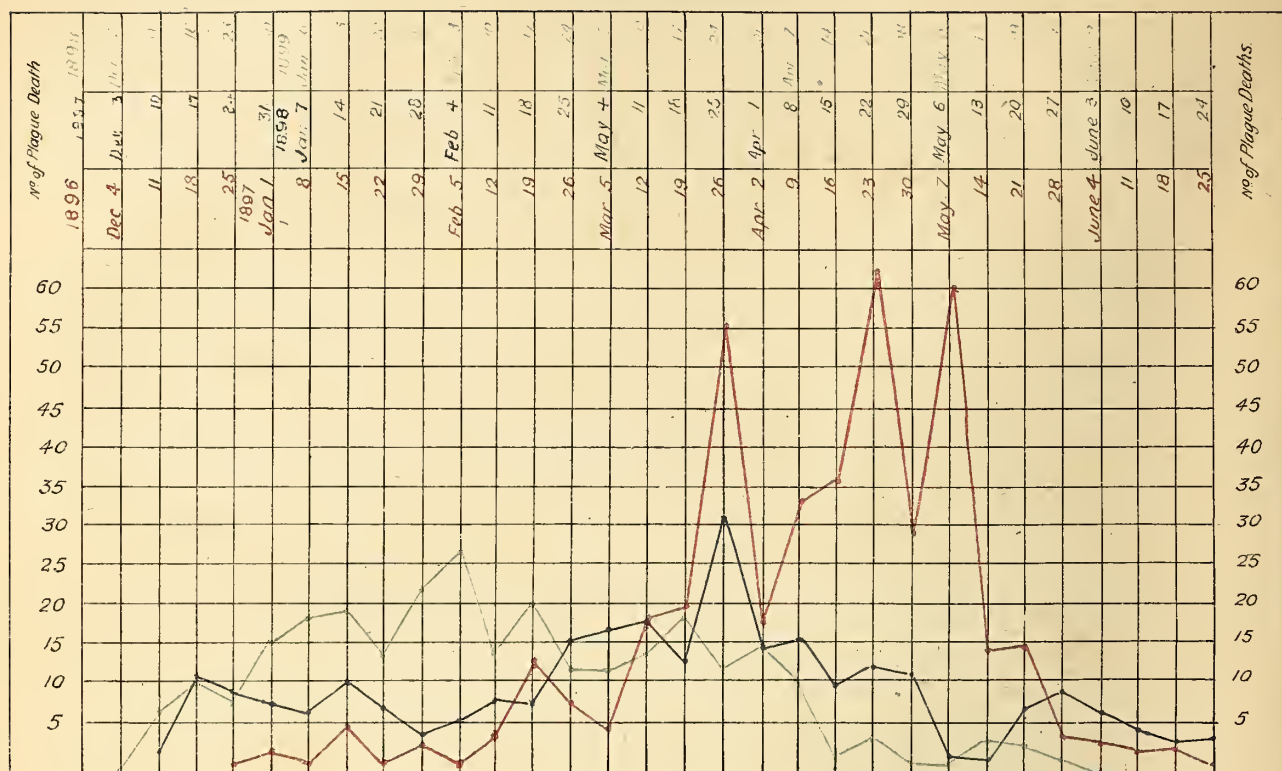
No further cases occurred until October 1897; at any rate none were discovered, although there was a possibility of

concealed cases, the orders for the compulsory notification of deaths having been withdrawn. In the week ending 1st October 1897, 5 cases were reported in houses in which there had been cases, but which had been disinfected during the previous epidemic. Whether these cases were due to a recrudescence of the disease or to a fresh importation of infection—for the occupants had just previously visited Bombay—was not determined. During the next two weeks there were no fresh cases, but in the week ending 22nd October 1897 2 more cases were reported from the Koliwáda, which, however, was immediately evacuated. This was followed by another lull, and up to the week ending 10th December 1897 only 4 more cases were registered. This was in all probability the effect of prompt evacuation, but in the meanwhile the disease gained strength and broke out elsewhere, the week's record for the 17th December 1897 being 11 attacks—9 deaths. It then continued, but the fluctuations in the number of attacks were curious; and can be best illustrated by a statement:—

Week ending	Cases.	Deaths.	Week ending	Cases.	Deaths.
			Brought forward ..	89	68
October 1st, 1897	5	1	February 25th, 1898	20	14
" 8th "	...	2	March 4th "	23	15
" 15th "	...	...	" 11th "	16	16
" 22nd "	2	1	" 18th "	14	12
" 29th "	1	1	" 25th "	43	30
November 5th "	1	...	April 1st "	12	13
" 12th "	...	...	" 8th "	17	14
" 19th "	2	2	" 15th "	12	8
" 26th "	...	...	" 22nd "	14	11
December 3rd "	...	...	" 29th "	9	10
" 10th "	...	...	May 6th "	1	1
" 17th "	11	9	" 13th "	2	1
" 24th "	10	7	" 20th "	8	7
" 31st "	8	6	" 27th "	9	8
January 7th, 1898	5	5	June 3rd "	6	6
" 14th "	11	8	" 10th "	5	4
" 21st "	5	6	" 17th "	4	3
" 28th "	5	3	" 24th "	4	3
February 4th "	6	4			
" 11th "	7	7	Total ...	308	244
" 18th "	10	6	Add, July 1898 ...	24	20
Total up to 18th Feb. 1898	89	68	Total ..	332	264

BASSEIN

Population 11291



So far the usual measures of segregation and disinfection had been adopted ; evacuation, though practised to some extent, was not general. About this time an attempt was made to seek the good-will of the people by permitting the sick to remain in their houses with only one or two attendants. The results were not attended with any evil consequences. The disease, however, never completely disappeared, and during the third epidemic again threatened to assume a serious form.

The Town of Bándra, being the favourite suburb of Bombay, is largely crowded by Bombay people, thousands of whom visit the City daily. Its overcrowded state rendered it desirable to prevent an indiscriminate influx of people into Bándra. The Municipality,

Bándra.
Population—18,759.

therefore, opened an Observation Camp on the 1st January 1898, which gave place in a month to the Government Segregation Camp. From an earlier date efforts were being made in other directions. Bándra Town managed to keep free from plague till the first week in January 1898, when two indigenous cases occurred in the Khar quarter, the infection having been imported from Bombay. The whole of the Kharwada was evacuated and the people turned out into sheds, but cases continued to occur in the sheds until the middle of March, when, after a week's cessation, the epidemic broke out afresh and continued with varying severity till June 1898. The monthly numbers of indigenous cases and deaths were:—

Month.	Cases.	Deaths.
January 1898...	4	3
February " " "	22	21
March " " "	14	15
April " " "	54	41
May " " "	56	51
June " " "	8	8
Total...	158	139

Bháyндar is a village on the extreme north of the Sálsette Táluka on the B. B. & C. I. Railway and on the creek that separates the Sálsette and Bassein Tálukas. The normal population is about 2,700, but every year there is a large influx of men engaged in the various salt-works in the neighbourhood. The second epidemic began here with 2 cases in the week ending 25th February 1898 and ended on the 29th May 1898.

Bháyндar.
Population—2,697.

The source of infection could not be definitely traced, but the first cases occurred in houses in which there had been plague during the previous epidemic, though in the meanwhile they had been disinfected. The whole of the village was evacuated by the middle of March, but the stealthy visits paid by the evicts to their houses kept the disease alive. The following are the monthly figures :—

Month.			Cases.	Deaths.
February	...	...	2	2
March	...	...	25	19
April	...	...	51	33
May	...	...	7	8
Total			85	62

Utan is a fishing village which lies between Dongri and Gorái. During the first epidemic this village practically escaped, only one imported and one indigenous case having been discovered ; but during the second epidemic indigenous cases numbered 92 and deaths 72. The first case occurred about the 28th December 1897. Infection in this instance was most probably due to importation from Bombay through the men engaged in the fruit and vegetable trade with that city, which is of considerable magnitude, and was never put a stop to. The village was evacuated by the middle of January, but cases continued occurring until the end of March, mostly due, as in other places, to surreptitious visits to the evacuated houses. The subjoined statement gives the monthly number of cases and deaths :—

Utan.
Population—3,147.

Months.			Cases.	Deaths.
January	...	...	36	32
February	...	...	27	26
March...	...	...	28	23
Total...			91	81

The town of Thána practically escaped during the second epidemic; in the District 66 villages were infected. The measures adopted throughout the District were alike : being briefly evacuation, segregation

Thána District.

of contacts, and disinfection of houses. The following statement shows the numbers of cases and deaths throughout the whole District during the second epidemic :—

Months.	Cases.	Deaths.
August 1897... ..	33	27
September „ ..	100	76
October „ ..	74	52
November „ ..	30	24
December „ ..	79	58
January 1898... ..	93	69
February „ ..	141	116
March „ ..	279	213
April „ ..	472	352
May „ ..	254	208
Total...	1,555	1,195

Third Epidemic (June 1898—June 1899).—The termination of the second epidemic in the District coincided with the commencement of the third; there being hardly any break: Bhiwndi being the first place to fall.

The town of Bhiwndi, which, after passing through a very virulent outbreak in 1897, managed, except for occasional sporadic cases, to maintain a tolerably clean bill of health from the beginning of May 1897, was attacked for the second time in the week ending 15th April 1898, and went through an exceptionally severe epidemic.

Bhiwndi.
Population—14,387.

There is no clear history of either a recrudescence or re-infection, but probably the disease was lurking in the town and had passed unnoticed. Consequent on the 1898 monsoon breaking early in June, recourse to evacuation had to be abandoned, but the Collector, Mr. R. P. Barrow, I. C. S., finding the people somewhat uneasy as to the suppressive measures to be adopted, went personally to Bhiwndi and made the following arrangements in consultation with the heads of the various communities there :—

“Hospital accommodation was at once provided, various dharmshālas, school-houses and other buildings were taken up as contact segregation camps for special classes, while two camps, one at either end of the town, were erected for the use of the lower classes, Mahomedan and Hindu. Sheds made of bamboo matting and jawlis were found to be fairly water-tight, the great difficulty being that of obtaining a dry floor, and to get over this, floors of split bamboos were tried.”

Disinfection and untiling of houses, where cases occurred, were carried on. All attempts to introduce inoculation failed. It is noteworthy that the southern portion of the Municipal Town known as Nizámpur remained unaffected up to the middle of July, although intercourse between Bhiwndi and Nizámpur was quite unrestricted.

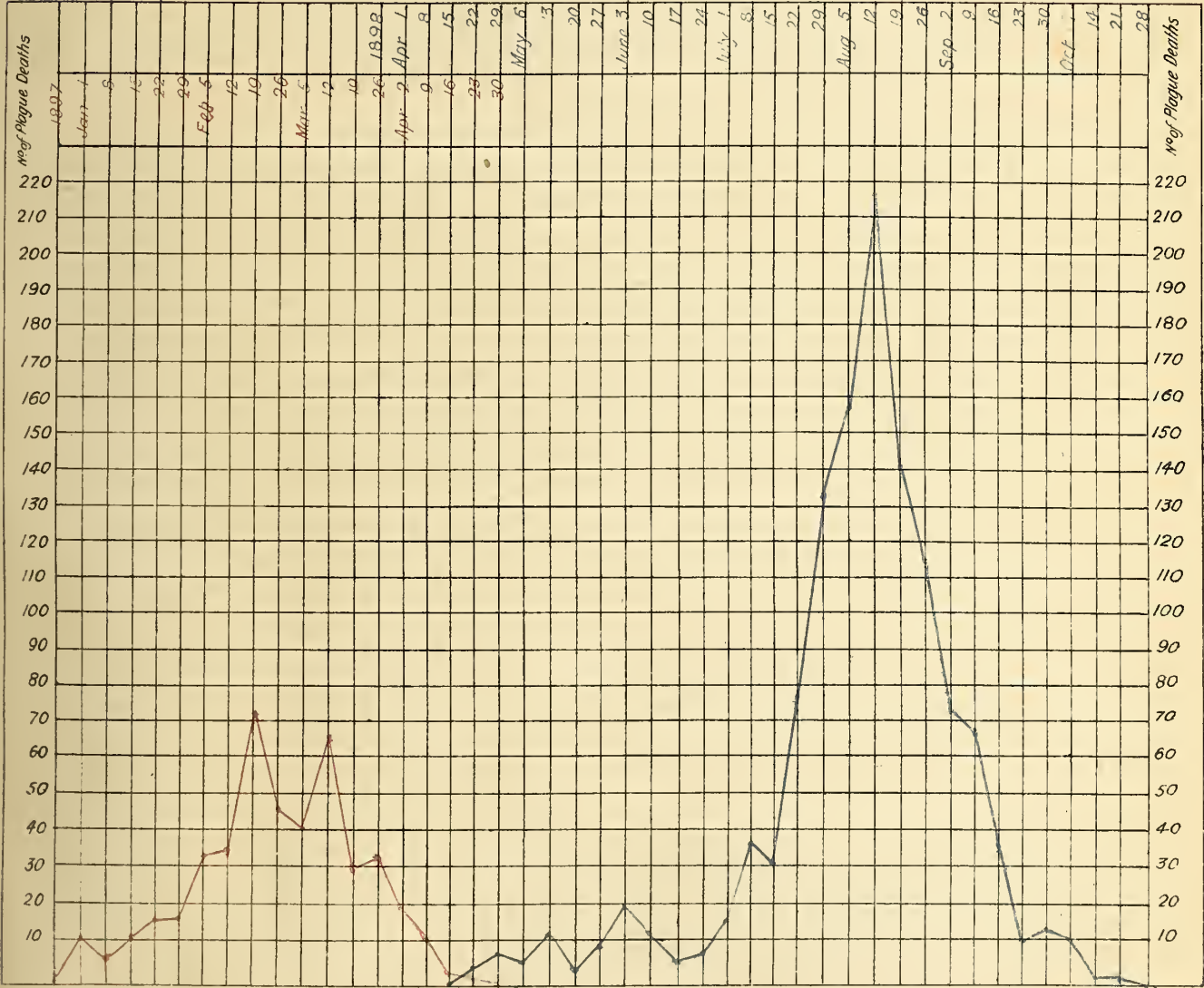
Lieut.-Colonel Hay, I.S.C., was sent to Bhiwndi immediately after he made over charge of the Kalyán detention camp. A Hospital Assistant aided him. Later on, however, it became necessary to apply for additional medical aid, which arrived in July 1898 in the persons of Drs. Hill and Dalál, Assistant Surgeon Pettigara, and three other Hospital Assistants. All efforts, however, proved fruitless, and the disease rapidly grew worse.

The climax was now reached, and whether owing to the measures which continued to be carried on with rare energy and perseverance, or to other causes, the figures steadily

declined, and by the end of October the epidemic was at an end. The following were the monthly figures :—

Month.					Cases.	Deaths.
April	1898	...	...	...	18	14
May	"	...	...	...	60	43
June	"	...	...	...	59	39
July	"	...	...	...	490	322
August	"	...	...	...	881	627
September	"	...	...	...	270	200
October	"	...	...	...	11	14
Total ...					1,789	1,259

BHIWNDI
Population 14,387



While plague was fast depopulating Bhiwandi, the town of Kalyán, which is situated in the neighbourhood of Bhiwandi and at the point of junction of the two branches of the G. I. P. Railway, was defending

Kalyán.
Population—11,685.

itself against infection, but at length, after having been free of plague from January 1898, succumbed in August of the same year.

A few imported cases were discovered in July, but the week ending 15th August 1898 marked the beginning of a third epidemic. Slow at first in assuming serious proportions, the disease gradually increased, till, towards the end of December, plague began in earnest, and reached its highest point in the week ending 13th January 1899, when 47 cases with 39 deaths were recorded. Thenceforward it gradually subsided, and disappeared finally in April, the following numbers of cases and deaths having been recorded :—

Period.				Cases.	Deaths.
August to November 1898	...	...		43	35
December 1898	...	...		55	45
January 1899	...	...		138	115
February to March 1899	...	...		53	50
Total				289	245

Evacuation of infected houses and quarters was effected whenever possible with satisfactory results, but the progress of the disease was unfortunately much aided by the hostile attitude of the people to the segregation of contacts.

The town of Bassein, which passed through a protracted outbreak during the preceding epidemic, was again to suffer during the third epidemic. The second outbreak at Bassein had commenced so early as December 1897, and although a year had passed, plague was still there in spite of great efforts. In August and September 1898 the figures had declined, and when for three weeks no case occurred, every hope was entertained that the end had come. But in November cases began to occur again in the Bhandárwáda—always a bad quarter. The Koliwáda and Bhandárwáda were at once evacuated, and the measures previously in force were continued, but without much apparent effect. This outbreak lasted up to the middle of April 1899, but reached its worst point in the first week in February of that year, during which 30 cases and 27 deaths were recorded. Below are the figures for the third epidemic in this place :—

Period.				Cases.	Deaths.
November and December 1898	...	...		83	62
January 1899	...	...		82	72
February	..	...		77	72
March	..	...		74	72
April	..	...		29	26
Total				345	304

Evacuation was in high favour with the people of this town, as will be seen from the fact that the Koliwáda and Bhandárwáda sections were both vacated early in November, and by the middle of December it was estimated that about half the population of Bassein had moved out into sheds of their own accord. Bassein is conspicuous for the complete absence of assistance from private persons or Municipal Commissioners in carrying out plague measures : as also for the low percentage of mortality, considering the protracted duration of the epidemic ; this last being probably due to the large extent to which the town was evacuated.

Thána, the head-quarter station of the District, escaped rather lightly in the first two epidemics, but suffered somewhat severely in the third, the source of infection being undoubtedly importation from Bombay. With the exception of a few sporadic cases now and then, this town was really free from the cessation of the first visitation in May 1897 up to July 1898, when a fresh outbreak began, which lasted up to October; the worst month being August, when there were 90 cases. The Mahráttas suffered most heavily. Cases occurred during this epidemic in 45 houses in which they occurred in 1897-98, and in 94 fresh houses in the immediate vicinity thereof: although found in some cases, dead rats were not so numerous as in previous years. A Plague Hospital and Contact Camp did good work all through the year, but there was no Observation Camp. Infected houses were disinfected and untiled as usual. Here too evacuation was freely resorted to by the people, who even in the rains readily went out into sheds in the outskirts of the town of their own accord, the poorer classes being encouraged to do so by the free gift of hutting materials provided from a fund raised locally for the purpose. It is noteworthy that not one of 201 persons who were inoculated by the Acting Civil Surgeon, was subsequently attacked by plague. The following are the monthly figures for the epidemic in Thána Town :—

Thána.
Population—17,455.

Months.				Cases.	Deaths.
August	1898	...	...	90	62
September	„	...	...	78	57
October	„	...	...	28	29
Total				196	148

Yet another outbreak occurred in Bándra. From the beginning of June 1898 to the middle of May 1899 this suburb was never free from plague. The outbreak, which began early in June, resulted in 175 cases up to the beginning of September, after which it greatly subsided; but from the beginning of January 1899 the figures again rose, the disease continuing till the middle of May. (This outbreak, curiously enough, appears to have commenced in a hut built on the site of an old one, which, having produced the first case in 1896, was burnt down.) By the 15th of January 1899 cases were being discovered all over Bándra, and it could not be said that any particular localities were more especially affected. Doctor D'Monte, the Vice-President of the Municipality, took charge of all arrangements. Evacuation was voluntarily adopted by the inmates of all the numerous small villages which go to make up Bándra: even Dánda, the fishing hamlet, with its population of close on 5,000 sturdy and self-willed fishermen, was cleared out without trouble by Dr. D'Monte with the aid of one of the Municipal Commissioners, Mr. Motirá́m Patel. A good many cases occurred in the sheds to which the evicts were removed, and it was due to this that even with considerable evacuation the returns continued heavy. Wherever possible, these huts were burned down and the occupants removed to other huts. The sick were carried to a hospital built at Khar, a suburb of Bándra; but where this was objected to, patients

Báandra.
Population—18,759.

were allowed to be treated in their own huts outside the town, and were even allowed to be treated in their own houses in cases in which suitable arrangements could be made for the purpose. The markets were removed to an open place and notification of attacks and deaths was made compulsory. By these means the outbreak was eventually controlled. The following statement shows the monthly numbers of cases and deaths :—

Months.				Cases.	Deaths.
January	1899	...	...	47	38
February	„	...	...	96	80
March	„	...	...	126	110
April	„	...	...	85	72
May	„	...	.	32	29
Total ...				386	329

Throughout the rest of the District the third epidemic affected no less than 149 villages, of which 77 were unaffected during the previous epidemic. The villages comprising the Sálsette and Bassein Tálukas were affected all the year through, with scarcely a break ; of the other Tálukas, Bhiwndi suffered most during the rains, Kalyán during the cold weather, Máhim, Dáhánu and Murbad at the end of the cold and the beginning of the hot weather.

The following are the figures for the villages :—

Months.				Cases.	Deaths.
July	1898	...	...	170	140
August	„	...	...	152	127
September	„	...	...	103	88
October	„	...	...	76	71
November	„	...	...	75	59
December	„	...	...	115	86
January	1899	...	...	273	215
February	„	...	...	594	467
March	„	...	...	1,055	883
April	„	...	...	626	503
May	„	...	...	255	214
June	„	...	...	30	21
Total ...				3,524	2,874

Disinfection with chemicals was early discontinued, as it was found unsatisfactory in the hands of any but skilled men, untiling and increased ventilation being found good substitutes. Evacuation, which met with much voluntary adoption throughout the District, was found to be one of the most reliable and successful measures taken to suppress the disease, but inoculation was not popular.

CHAPTER VIII.

THE CENTRAL DIVISION.

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AHMEDNAGAR DISTRICT.

Area	6,645 sq. miles.
Population in 1891	888,755.
Density of population	134 per sq. mile.
Rain-fall	...	...	...	...	...	...	21 inches.

The boundaries of the Ahmednagar District are roughly as follows:—north-west and north, Násik; north-east, east, and south-east, Nizám's territory; south, Sholapur; south-west, Poona; west, Thána.

The climate is on the whole good. From November to February the air is dry and invigorating. From February to May a hot dry wind blows, which is followed by sultry weather, lasting till the bursting of the monsoon towards the end of June, when the climate again becomes temperate and pleasant.

Partly owing to the absence of trees, partly to the ruined condition of so many village walls, partly also to the geological conformation of the hills, the general aspect of the open country of Ahmednagar is desolate. The soil is of three sorts—black, red, and grey. The whole District forms part of the great “trap” region of the Deccan. It is drained by two chief rivers—the Godávári and the Bhíma, draining the north and south respectively—and is well watered by these and numerous tributaries.

Previous epidemics. There is no authentic record of plague in Ahmednagar previous to 1896.*

First Epidemic (September 1897—March 1898).—Precautions against the plague began in Ahmednagar as early as September 1896, and before Mr. F. L. Charles, I. C. S., gave over charge of the District in March 1897, suitable local regulations had been framed, a Plague Hospital had been arranged, and an excellent Observation Camp had been established at the Railway Station. Forty-eight imported cases (32 fatal) occurred in the Ahmednagar District from the middle of December 1896 to the beginning of April 1897, from which time up to August 1897, plague had not re-appeared; nor, at first, did the adjacent Districts constitute a menace to its safety. With the outbreak at Sirur (July 1897) this immunity ceased to exist, and imported cases began to occur with increasing frequency at Hingani, Rahuri, Sangamner, Chichondi, and Nagar Town—the first imported case occurring at Hingani on the 3rd August 1897, and from this date to the 17th of September 1897, 24 imported cases (18 fatal) occurred in all.

So far there had been no case of indigenous plague in either Town or District, and every effort was put forth to prevent its obtaining a footing. With this object representations were made to the Sirur authorities; registration and medical examination of all arrivals (whether by road or rail) from Bombay, Kirkee, Sirur, and Igatpuri was instituted; the cleansing and better sanitation of Nagar Town was taken in hand, and the preparation of the Siddhi Bágh Hospital was pushed forward.

* *Bombay Gazetteer*, Vol. XVII.

At length, in the week ending 24th September 1897, indigenous plague appeared. The first case reported occurred in the compound of a Roman Catholic priest in Cantonments. But it is at least doubtful if this was in reality the first indigenous case, for previous to this a death had been concealed and the corpse had been secretly conveyed for disposal to Shahapur—a hamlet five miles north-east of Nagar. The next 3 cases occurred amongst the *Gaolis* in the vicinity of the Roman Catholic Church. “The infection,” says the Collector, “would appear to have been brought from Sirur, a place with which they are intimately connected.”

On the occurrence of another case, in the first week of October, the evacuation of the Sadar Bazár in Cantonments was determined on, and carried out with great promptness—only 24 hours’ notice being given.

Owing to the evacuation of the Sadar Bazár and the rise of plague in Poona, further steps were taken for the protection of Nagar Town, and on the 1st of October 1897, the Railway Station Camp was re-opened. At this Camp, subject to certain exceptions, and subject to release on surveillance, all persons were detained who arrived by rail or by the roads approaching Ahmednagar from the west. The Civil Surgeon, Major H. W. Stevenson, I. M. S., held classes for the instruction of Revenue and Municipal Officers in plague measures generally, and practical demonstrations were given of the methods of disinfection.

As cases continued to occur in Cantonments, although the inhabitants were in Camp, still further precautions were taken to protect Nagar Town. On the 8th of October 1897, the Sarjapur Dharamsála was prepared as a Segregation Camp; from the 9th, all the gates of the City, except five, were closed, and people were not allowed in unless known; and on the 10th, Plague Authorities were appointed.

The 5th of November 1897 marks a new period in the course of plague in Ahmednagar. The evacuated population of Cantonments had been permitted to return to their houses to whitewash them. This step was followed by a rise in the number of cases and by the occurrence of indigenous plague both in Nagar Town and in Bhingar. The following week (5th—12th November) 5 cases occurred in Nagar and 5 in Bhingar, and all doubt as to their infection was at an end. The Collector ascribes its origin in each case to the Sadar Bazár (Cantonments):—

“ . . . As far as evidence is procurable, it seems that the infection is traceable to the exit of people from the Sadar Bazár. One of the first cases was that of a Barber boy living near the Zenda Gate, who attended the funerals of some refugees from the Sadar Bazár, who had fallen ill of a fatal disease on their way to the Moglai, which is only some 12 miles distant. The boy was attacked on his return; and at about the same time an inhabitant of the Máliwáda quarter visited a prostitute in the Sadar Bazár during the temporary re-occupation, and on his return died of virulent plague in the Hospital. There seems no doubt about these facts; but the conclusion that Bhingar was infected from the Sadar Bazár is based not only on inherent probability . . . but also on the report of the Bhingar Plague Mámlatdár, who states that the first case (since an isolated one brought from Kirkee on September the 16th) was brought by a *máli* from Cantonments on the 10th November, the second by a grain-seller, and the third by a Dhangar, all from the Sadar Bazár.”

The measures taken on the occurrence of these cases in the City were vigorous and prompt. Whole blocks of houses, near the houses in which plague had occurred, were at once emptied and their inmates conveyed to the Sarjapur Dharamsála for disinfection and segregation. An inspecting staff, specially trained in disinfection work by Major H. W. Stevenson, I. M. S., was organized for each of the 12 wards of the City. This staff consisted

of 12 Superintendents and 60 Supervisors. The latter were Municipal School-masters and Inspectors, and were responsible for the discovery of cases.

In view of the probability of an outbreak the Collector had been endeavouring to persuade the people to provide themselves with temporary accommodation in the neighbourhood of the Town, so as to avoid the discomfort of hurried evacuation and segregation. They had not done much, however, in the way of making encampments for themselves, but the object-lesson of two or three hundred people having to go into strict segregation the very first day on which a case occurred in the Town, provided a stimulus that had been hitherto wanting. On the 6th November an exodus began from the Town, which ultimately effectually emptied it. It was estimated that during this fortnight alone (5th—19th November 1897) no less than 10,000, out of a total population of about 37,000, fled. After the exodus had continued for eight days, it was resolved to attempt to prevent further flight, but this decision was wisely abandoned on the advice of the Civil Surgeon. Till then the Town was practically uninfected, and the exodus does not appear to have disseminated the infection.

Eight cases having been reported from the Post Office and other buildings at the Railway Station (some two miles out of Nagar) during the week ending the 5th November, and 2 more cases in the following week, the whole of these buildings, including the Post Office, were evacuated.

During the week ending 19th November, 5 cases were reported in the Town, but it was not considered necessary to evacuate more than the surrounding blocks of houses in each case. The Savedi Camp was begun during this week, to provide for complete evacuation should this become necessary. The following week, the Savedi Camp, with 1,000 huts and 1,000 sites for huts, was pronounced ready, and 8 more cases occurring, the evacuation of Wards IV, V, and VI was ordered.

But the exodus, the beginning of which has already been noticed, had proceeded very rapidly, and, by the end of November 1897, out of a population of about 37,000, only 12,000 remained. Of these, 5,000 were in Camp and 7,000 in the Town. The Collector makes the following estimates of the distribution of the missing 25,000 :—

“ . . . The Kopergaon Talnka received 2,000 . . . Sangamner 225, Nagar Talnka 8,857, Rahuri 786 . . . Akola 32, Nevasa 849, Sheogaon 106 . . . , while Shrigonda, Pärner, Karjat, and Jámkhed received a very considerable influx. Of the remaining 10,000, large numbers, it is believed, proceeded to His Highness the Nizám's dominions . . . ’

During the week ending the 11th December 1897, a further development took place in plague operations, European supervision being introduced into every branch. The arrangements made were as follows:—Ward XII was emptied, and Mr. C. N. Clifton, Executive Engineer, P. W. D., was placed in charge of the disinfecting, cleansing, and unroofing operations in Nagar, with Mr. W. H. J. Wilkinson, I. C. S., Mr. R. J. Kent, P. W. D., and Mr. Watson, Municipal Engineer, as his assistants: Mr. C. S. F. Crofton, I. C. S., superintending at Bhingar, a large suburb of Nagar. Mr. L. W. Spence, District Superintendent of Police, also took charge of two wards in addition to his own duties.

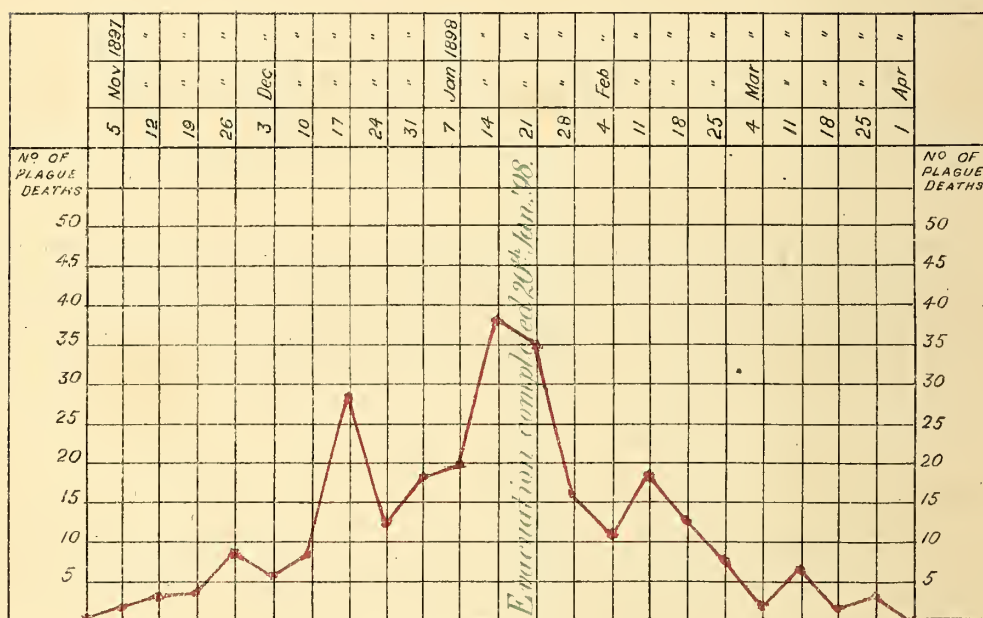
The following week saw plague at its height. The District returned 108 cases, of which 30 occurred in Nagar.

The weekly figures for the epidemic were :—

AHMEDNAGAR—POPULATION, 36,000.

Week ending	Cases.	Deaths.	Week ending	Cases.	Deaths.
5th November 1897 ...	1	1	25th January 1898 ...	21	17
12th " " ...	5	3	4th February " ...	10	11
19th " " ...	5	3	11th " " ...	21	18
26th " " ...	10	8	18th " " ...	15	13
3rd December " ...	7	6	25th " " ...	7	8
10th " " ...	12	8	4th March " ...	4	2
17th " " ...	34	29	11th " " ...	6	7
24th " " ...	16	12	18th " " ...	3	2
31st " " ...	21	18	25th " " ...	3	3
7th January 1898 ...	30	20			
14th " " ...	42	39	Total ...	310	264
21st " " ...	37	36			

AHMEDNAGAR TOWN.



On the 20th December, Lieutenant R. W. Boger, R.A., and one Officer and 20 men of the East Yorkshire Regiment were sent to the Collector for plague duty, and the work of unroofing, disinfecting, and general sanitation proceeded apace; and from this time the number of cases steadily declined. Further measures were now enforced to prevent the disease spreading into the District. Police guards were posted at the Sina Bridge, Sávedi, Shendi, and at eight other road stations, to prevent persons suffering from plague being carried out of the Town. The Collector endeavoured in every way to lighten the burden of plague measures for the people. Special passes were issued to shopkeepers, so that business might not cease. Owners were permitted to open up their own houses if situated in a non-infected locality. But this last concession proved a means for the people to render nugatory this important step, for the Collector reports:—

“But this did not prove an unqualified success. At first they were all willing to do what was required of them; but with exceptions (notably in Ward V, where the work was, as a whole, well done) the holes made for ventilation were well below the size prescribed, rooms were in many cases left quite unventilated, rags and filthy clothing were locked into cupboards or otherwise secreted, and in some cases were deliberately built into corners. . . . In few cases were even doors and window-shutters left open, often these had to be torn off to prevent the owners shutting them, and this, too, where there was no property or money stored. . . .”

Every house which appeared to require it was thus opened up, ventilated and cleaned; and in the beginning of January 1898, Wards I, III, IX, and XI were evacuated. Wards VII, VIII, and X were emptied three weeks later. This completed the evacuation of the entire Town. As regards the spread of the infection, neither rats nor grain would seem to have been responsible for it, for very few, if any, dead rats were found; and as regards grain, the Collector reports: "No case is reported where infection is traceable to grain." But in parts of the District, cases of cats, rats, and mice were reported. Cases of cats dying with plague symptoms were also found in Nagar; and a reward of one anna was offered for every cat killed. The authority for the diagnosis was the Civil Surgeon. From the middle of January 1898 the numbers declined: by the end of February plague had ceased.

During the week ending the 18th of February 1898, more soldiers had been applied for, to assist in the opening up of the wards vacated at the beginning of the month, and the number was raised from 20 to 50: Lieutenant R. W. Boger, R. A., relieving Lieutenant B. D. Broughton, East Yorkshire Regiment, in the command.

In the District indigenous plague first appeared at Jaola, Táluka Párner, five cases occurring on the 29th September 1897. Mr. J. Ghosal, I. C. S., Ahmednagar District. Assistant Collector, was at once sent there, and carried out segregation of all families in which a suspicious death had occurred within the last five weeks, and disinfection of infected houses. A special Native Medical Officer was sent from Nagar to assist him; and Police were also despatched to prevent persons from leaving for 8 days. Evacuation was impossible on account of the rains; and the Collector states: "To this perhaps is to be attributed the long continuance of plague there."

A flying column sent out by the Surgeon-General, which had its head-quarters at Sirur in the Poona District, assisted in the operations. Cases continued to rise, and on the 15th October the evacuation of Jaola was ordered, the rains having presumably ceased. An observation made by the Collector at this time may here be quoted as supporting the probability that rats carried about the infection:—

"It is noticeable that the plague had spread from the quarter which had been evacuated to parts still occupied clearly without any human communication. Dead rats, found in the roofs of infected houses when opened up, point to their being the means of conveying infection."

The hamlet of Sháhápúr, some 5 miles from Nagar Town, was now found to be infected (6 cases), and was evacuated at once, its 58 inhabitants being transported to the Nagar Camp. Only one case occurred amongst them in Camp, and thereafter they were free from plague. In the vicinity of Nagar and its Cantonments infection seems to have been disseminated chiefly by the *Gaolies*.

During the week ending the 15th October 1897, it was rumoured that there was plague at Rájápúr (population, 1,532), close to Sirur in Shrigonda Táluka, and this rumour was confirmed during the following week.

The rapidly increasing weekly plague mortality in this village $\left\{ \begin{array}{c} \text{Cases} \\ 5-10-25 \end{array} \right\}$ for weeks ending $\left\{ \begin{array}{c} 9\text{th}-16\text{th}-22\text{nd October} \end{array} \right\}$ appears to point to the serious consequences resulting from concealment and the absence of any combative measures: an example was made of those responsible. The Collector's report of this little epidemic is interesting:—

"The Rájápur outbreak appears to have been concealed by the village officials for at least a fortnight. It began on October 2nd, and showed 9 cases on 16th, and 22 cases on the 19th. The village officers were suspended The means of introductions of the plague has not been ascertained. Suspicion was aroused by the high mortality. The disease began amongst the Mahárs and Chambhars Mr. Ghosal proceeded to the spot, took a census of the village, built a camp with mats and bamboos sent from Nagar, and had the place evacuated. Poor persons segregated were fed at the expense of the Local Board, blankets being supplied from charitable funds. But the people seem to have been refractory on being turned out of the village and Mr. Ghosal thought it wise to send for a reinforcement of Police from Nagar."

Later information, however, pointed to Sirur being responsible for the infection of Rájápur. Mr. Ghosal states that the brother of a Márwári from Sirur, who died of the plague, presented the clothing of the deceased to a family of Mahárs, of whom five caught the infection and died. Within a fortnight after evacuation plague had ceased, during which time only 4 more cases had occurred.

Jaola still continued to show plague, and during the week ending 12th November 1897, reported 10 cases. Mr. R. C. Brown, I. C. S., who now succeeded Mr. Ghosal there, reported great difficulty in the matter of disposing of bodies. "He states," writes the Collector, "that buriers refused to work even at Rs. 12 a month, that burning was expensive (costing at least Rs. 4), and that the burial-ground of Jaola was in an insanitary state—the graves were shallow and malodorous, and had in some cases been rooted up by animals." Ultimately Mahárs were engaged at Rs. 15 a month for the work.

Three cases of plague occurred at this time in Pimpalner (Párner Táluka). It was promptly vacated. The large village of Nighoj (population, 2,722) in the same Táluka was attacked on the 14th November. It was also promptly vacated under Mr. Brown's directions, and the outbreak rapidly subsided. Another outbreak, which caused serious anxiety, was at Rájur (population, 1,959), the market town of the western portion of the Akola Táluka. Mr. Kent, Assistant Engineer, was sent from Nagar to deal with this attack, and the epidemic was soon suppressed.

Before and during the time when these events were in progress, circulars were issued from time to time to all the village officers in the District with the object of restoring confidence and inducing co-operation in Government measures. The people were repeatedly urged to protect themselves from the invasion of infection, and advised as to what they should do if an outbreak occurred. It may also be noted that the Civil Surgeon had always a party of trained disinfectors with appliances ready to send out to the Districts at a moment's notice. As soon as a party was sent out a fresh set of men was engaged and trained.

Camps were established at the following places:—Dhond, Nagar Railway Station
Cantonments, Kápurvádi, and Sávedi. These Camps were of two
Camps. kinds—Observation Camps and Health Camps. Some of those
just mentioned served both purposes, *e.g.*, the Cantonment Camp and that of the Railway Station.

Of the Observation Camps, the largest and most important was that at Dhond. Although in the Poona District, it had for its object the protection of Ahmednagar District, and its history may therefore appropriately find a place here. The object of this Camp was to check the influx of passengers coming from infected districts by the G. I. P. Railway; and it might be termed the southern gate of the Ahmednagar District. It was established on the 3rd December 1897, Mr. K. C. Rushton, Assistant Superintendent of Police, being placed in charge. It was situated some 300 yards to the south of the Railway Station,

and consisted of 70 huts in 7 rows of 10 each, all facing north. It had baths, latrines, and, ultimately, a good water-supply laid on from the station reservoir. It was protected by a fence of brambles, and guarded by a Police guard formed from a force of 2 Head Constables and 12 Policemen supplied by the Poona District. With a few exceptions, all passengers by the G. I. P. Railway arriving at Dhond were detained there for ten days. At 7 A.M. every morning there was a roll-call of all the passengers thus detained; and disinfection with perchloride solution was carried out between 9 A.M. and 12 noon. Food was supplied at cheap rates, and about two-thirds of the passengers detained were fed at Government expense. After completing ten days in the Camp, passengers were carefully examined by Assistant Surgeon C. M. Rodrigues on the eve of departure. Later, Mr. P. S. Bhátýe was placed in charge of this Camp, which throughout fulfilled its object most efficiently. The conduct of the people was good.

As has been already stated, the Railway Station Camp and the Cantonment Camp were also in part Observation Camps, and, as such, both were useful.

The statistics of the Dhond Camp and of the Railway Station Camp are given below:—

Name of Camp.	Date of establishment.	Date of dissolution.	Total number detained.	Largest number detained in one week.	Found with suspicious symptoms and sent to Plague Hospital.	Developed Plague.	
						Cases.	Deaths.
Dhond Observation Camp.	3rd December 1897.	16th May 1898.	4,139	473 (during week ending 25th March 1898).	192	8	7
Railway Station Camp.	1st October 1897.	20th May 1898.	3,510	297 (during week ending 10th December 1897).	No record ...	9	9

The total cost of erecting, establishing, and maintaining these Camps was—

	Rs. a. p.		
Dhond Camp	4,037 11 10
Station Camp	3,827 14 0

To return to the District. By the week ending the 4th December 1897, plague had yielded to the prompt evacuation carried out in Pimpalner and Shrigonda. Nighoj, but during this week it had broken out in a severe form in Shrigonda, which reported no less than 30 cases. Shrigonda is one of the most important places in the District, and consists of the village itself and 10 hamlets. It is the head-quarters of the Táluka, and a large trading centre. In spite of its size and importance, however, it possesses no Dispensary, a defect which was much felt during the epidemic. The origin of plague there was probably importation from Sirur, but the fact that the disease was concealed for a week or two before its existence became known renders this a matter of conjecture. The chief action taken is thus described by the Collector:—

“The town was divided into 10 blocks. Each block was vacated as soon as any plague cases occurred in that part. This partial evacuation proved no success; and block after block had to be vacated; and the last two blocks were emptied before plague actually appeared in them. Thus by the 16th December the whole place had been evacuated. There was no Health Camp: most people erected their own huts, the poor being helped with some materials . . . There was a marked improvement immediately after evacuation.”

And by the end of December the number of cases had fallen to 1. But the disease did not at once die out as expected, for straggling cases continued to occur. This is attributed by the Collector to people constantly returning to the town:—

“It soon became apparent, however, that plague could not be altogether checked unless all communication ceased with the infected town; and all our energies were directed towards this end. Gradually, by the grant of some aid, partly from plague and partly from charitable funds, weavers and other artisans were persuaded to erect their workshops outside the village. A site was also chosen and fitted up for the weekly bazar. There a large Camp or market was erected, and all the merchants and shopkeepers induced to open their shops and offices in that Camp. In this way, by the end of January, the town had been quite emptied and all communication forbidden By the 15th January 1898 plague had practically disappeared.”

The total numbers of the attacks and deaths, as given by Mr. Ghosal, who was on the spot, were 139—118. “Even then,” he states, “probably many plague cases have been excluded.” The largest weekly number of cases in Ahmednagar District was reported during the week ending 18th December 1897, being 108.

Twenty-three towns and villages were attacked in all during this epidemic, excluding Nagar Town, Cantonments, and the Station. In 33 other villages imported cases of plague occurred. In several villages evacuation was spontaneously resorted to by the people before the occurrence of cases, and they escaped very lightly. Nagardewalá (1,106) and Athwád (436) are instances, and escaped with 9 cases each. Pendshet is a curious example, of which the Collector gives the following description:—

“ . . . at Pendshet, a little hill village in Akola with a population of 183, spontaneous evacuation stopped an outbreak of which nothing was known to the authorities until it had ceased, after accounting for 18 lives—10 per cent. of the population.”

The monthly plague mortality for Nagar Town and District throughout the epidemic was as follows:—

Month and year.	AHMEDNAGAR DISTRICT (excluding Nagar Town). Population—852,724.		AHMEDNAGAR TOWN. Population—36,031.	
	Cases.	Deaths.	Cases.	Deaths.
September 1897... ..	21	13	8	6
October „	155	106	2	...
November „	136	83	21	15
December „	205	164	90	73
January 1898	76	67	130	112
February „	83	68	53	50
March „	60	46	16	14
April „ ... ..	...	...	1	2
Total ...	736	547	321	272

On the 30th December 1897, Mr. C. W. M. Hudson, I.C.S., relieved Mr. A. F. Woodburn, I.C.S., as Collector.

From the end of April to the end of August 1898, the disease disappeared ; but since the end of August 1898 there has been plague in the District, as will be observed from the table below, but there has been no prolonged epidemic of any magnitude anywhere : a result apparently due, in a great measure, to the prompt measures taken to suppress an outbreak as soon as it occurred, evacuation being principally resorted to :—

Month and Year.	AHMEDNAGAR DISTRICT (excluding Nagar Town).		AHMEDNAGAR TOWN.	
	Cases.	Deaths.	Cases.	Deaths.
August 1898	1	1	...	...
September „	3	3	...	...
October „	4	2	7	7
November „	26	11	8	5
December „	71	60	1	1
January 1899	26	16	...	...
February „	28	19	10	8
March „	18	15	18	14
April „	2	2	7	6
May „	13	11	3	2
Total ...	198	140	54	43

Since the severe outbreak at Poona in June, July, and August 1899, however, Ahmednagar Town and District have both become badly infected, as the following figures show :—

Month and Year.	DISTRICT (Including Town.)		TOWN.	
	Cases.	Deaths.	Cases.	Deaths.
June 1899	14	11	...	...
July „	43	28	2	1
August „	409	310	98	81
September 1899	1,166	798	908	654

Note.—Imported plague has been omitted.

KHANDESH DISTRICT.

Area...	...	...	...	...	10,454 sq. miles.
Population in 1891	...	...	...	...	1,460,851.
Density of population	...	...	...	...	139·74 per sq. mile.
Rainfall	...	...	...	...	About 22 inches.

Khándesh, stretching nearly 160 miles along the Tápti, and forming an upland basin, varying in breadth from 70 to 90 miles, is the most northerly section of the Deccan table-land. Along the whole northern frontier, the District is bounded by the Sátputa range, from 30 to 40 miles wide; on the east and north-east, by Berár and Holkar's territory; on the south, by the Nizám's dominions; and on the west, by the Gaekwar's territory (Baroda) and by Rewa Kantha.

The Khándesh seasons are—the rainy season, from the middle of June to the middle of October; the cold season, from the middle of October to the middle of February; and the hot season, from the middle of February to the middle of June. Owing to variety of height, position, and character, the climate varies greatly in different parts of the District. In the western hills and forests, the rainfall from the south-west monsoon is heavy, but in the centre and south the fall is scanty and uncertain. As regards the general health of the people, the hot weather is the most healthy, and the cold weather the most unhealthy, season. In the beginning of the cold weather, the drying of the ground breeds much malaria, and later on, the great daily extremes of heat and cold are very trying. In Khándesh there are four hot springs: three in Chopda, and the fourth in Shirpur. All the varieties of soil that come under each of the three orders, black, red, and stony, are found in this District. Many of the chief streams flow during almost the whole year, but most of them are unfit for drinking, as their water is often polluted by the soaking of hemp and other fibrous plants.

Previous epidemics. There is no authentic record of plague in Khándesh previous to 1896.*

The first case of plague in this District occurred at Dhulia, the head-quarter station, on the 12th October 1896. The sufferer, who was a resident of Mándvi in Bombay, left Bombay on the 11th October. He was then suffering from high fever and was afraid he had plague. He went by rail to Chálisgaon, and thence by tonga, 34 miles, to Dhulia, which he reached in an unconscious state on the 12th. He was under observation from the time he arrived. The case was found by the Civil Surgeon, Lieut.-Colonel K. A. Dalál, I. M. S. to be one of plague, and the patient died on the 15th.

No indigenous cases occurred in the District till November 1897, and the imported cases were mostly found at the Bhusával Railway Station. Under Government orders the inspection at Bhusával of Railway passengers coming from Bombay began on the 1st November 1896. The inspecting staff consisted, at first, of one Hospital Assistant, but this was subsequently increased to two Assistant Surgeons and three or four Hospital Assistants. The first case detected among passengers was on the 3rd December 1896, and

Protective measures
at Bhusával.
November 1897.

* *Bombay Gazetteer*, Vol. XII.

from then till 18th June 1897, 37 cases were detected, of which only 17 proved fatal. From the 18th June till 3rd September 1897 only one more case (fatal) was detected. Hospital Assistant Námdeo Hari, who was first in charge at Bhusával, died of plague contracted in the discharge of his duty. To him, and to Assistant Surgeon Newing, who succeeded him, much credit is due for the efficiency of the inspection arrangements.

While the inspection of all passengers from Bombay was being carried on at Bhusával, local arrangements were made for the inspection of passengers leaving the train at Chálisgaon, Páchora and Jalgaon; and to guard against infection from Surat, similar local arrangements were made at Nandurbár and Navápur, for inspection of travellers by road when Surat became infected.

Plague in Jalgaon.
Population 14,672.

Up to the 1st November 1897 throughout the whole District 40 imported cases, with 18 deaths, had occurred, and it seemed probable that the exertions of the local authorities would be successful in entirely preventing an outbreak of indigenous plague. However, a suspicious case occurred in Jalgaon in the week ending 26th November 1897, and the Collector thus describes what followed:—

“You will have got a telegram from me saying that there is indigenous plague here and that apparently about 15 cases have occurred. The way in which deaths have been occurring in a special area, and 2 or 3 in the same house, and in considerable excess of the average, shows that there is something wrong. And the existence of buboes in two of the patients seems to show that it is plague the people are dying of. The opinion of the town is that it is not plague, and that the mortality is due to ordinary fever acting on constitutions undermined by famine. But the increase *lately* in the deaths and the *distribution* of the deaths seems to show that this is wrong.

The reason I gave 15 as the probable number of deaths (from plague) is that it represents roughly the excess over the average, and may therefore be taken as the product of the *special* cause, plague.

Pogson and Hatch and a European Abkári Inspector are here, and working hard at getting ready segregation sheds and trying to prevent infection going to Bhusával. Priestly, the Police Inspector, is expected to-morrow. We will have as thorough a house-to-house search as is possible, and we hope to get a large number of people to move out into the fields.”

The Plague Commissioner, with Surgeon-Major-General Cleghorn and Surgeon-Colonel Hay, visited Jalgaon at this time (2nd December 1897), and made the following notes on that town and Bhusával:—

“*Jalgaon*.—Population, 16,000. The first case of plague was discovered on the 23rd November, three other cases occurred in the same house, and there have been three others up to date. All these were confined to one quarter of the town. A Márwádi from Sholápur is said to have introduced the disease, but the evidence on this point is not clear.

The mortality for some time past has been above the normal, and within the last two or three weeks it has been about double of that in the same period last year. The bodies of those dying have been examined by a Hospital Assistant, but nothing found to justify the idea that the deaths were due to plague. No cases have been observed during the last two days, and no other place in the district appears to be infected.

The houses in which cases occurred have been evacuated and the inmates removed to huts which were hastily erected. We met Mr. Cumine, the Collector, here on the 5th instant; he had already selected a site for a camp, and as soon as the necessary number of huts have been erected, the whole of the inhabitants in the infected quarter will be removed to them, and the residents of other quarters will be persuaded to leave the town. Numbers of agriculturists are now departing and camping in their fields.

A mill-owner who employs 1,300 hands is making arrangements for hutting the whole of his employés, and the proprietors of several ginning and pressing mills, in which about 700 work-people are employed, will, it is expected, follow the same good example.

Mr. Cumine had before our arrival on the 5th instant organized four search parties, and we wired to Bombay for a gang of 20 coolies with all appliances and disinfectants. They will arrive to-morrow morning. Eighty more coolies will be entertained for disinfection and to learn the work. Mr. Priestley, of the Police Department, has been placed in charge of the operations, and he was sent to Násik on the evening of the 5th to make himself acquainted with the system of disinfection and the practical work carried out in connection with an infected locality. One of the recently arrived private practitioners from England will be posted to Jalgaon.

The appearance of the disease at Jalgaon renders necessary the introduction at Bhusával of measures calculated to prevent the spread of the disease towards the north.

The measures which will be adopted in Jalgaon may be effective as regards the inhabitants of the town, but, should other places in the district become infected, as travellers from infected districts avoid by road Manmád Station, then travel by rail to Bhusával and the north, it is evident that there will be a great liability to the extension of the disease to these parts. To enable us to take the necessary steps we visited Bhusával and arranged with the local Railway authorities for the erection of an observation camp at Bhusával. There is an excellent site for such a camp on railway ground near the station, and the District Traffic Superintendent informed us that he could construct huts made of sleepers, sufficient to accommodate 500 people within 24 hours.

He wired to the Agent, G. I. P. Railway, for the necessary sanction to this proposal. When everything is ready, booking of passengers between Manmád and Bhusával, except at Bhadli, a small Station between Jalgaon and Bhusával, will be open to every one, and all suspected travellers will be detained in the camp at Bhusával for a period not exceeding ten days. The officer in charge to have full powers of exemption and detention. The clothes and personal effects of those detained will be disinfected.

The Municipal Committee, under the supervision of Mr. Cumine, will also arrange for the establishment of a segregation camp for the residents of the town in the event of plague appearing in it. The Plague Hospital and segregation huts are already in construction, and the site for a health camp has been selected in the neighbourhood. The place appears to be at present free from the disease.

An Assistant Collector will be placed in charge at Bhusával, and we have applied for the services of a Staff Corps Officer to work under him."

With plague indigenous at Jalgaon and a certain number of people leaving it, it was to be expected that several cases of plague imported from Jalgaon would be heard of in villages. Accordingly, on the 28th of December 1897, the Collector reports :—

"A man who had gone about 8 days ago from Jalgaon to Datála in the Jalgaon Táluka died there on the 26th. His death was sudden, and so I assume it to have been plague. He had not been admitted into the village, but was living in a hut of jowári straw in the fields. The Mámlatdár has been to the place and burnt the man's clothes, and segregated the people with him, and demolished the hut."

On the following day he again reports :—

"A man who left Jalgaon a few days ago for Bhadgaon in the Páchora Táluka, and was kept in a segregation hut when he arrived there, has shewn signs of plague."

So also a week later (7th January 1898) :—

"It has been learnt that about 8 days ago a man, Bhavdu Rámchandra Wáni, aged about 16, went from Jalgaon to the village of Chincholi and died there in about 4 days. The cause of death is unknown, but I have assumed it to be plague. And the Mámlatdár had been out there and segregated the people of the house and the neighbours."

Fortunately none of the cases mentioned did as a fact infect the village into which it was imported.

On the 15th of January 1898 the Collector thus reviews the situation in Jalgaon :—

"As I have not yet sent any detailed account of the outbreak, I beg to do so now.

The first suspicious case—a man with buboes—was discovered on or about the 23rd November 1897. Looking back now with one's present knowledge, one sees that one ought to have been certain from the fact of there having been other deaths in the house that it was plague. At the time, however, I was not certain. The man was segregated. And the Assistant Collector, Mr. Hatch, came and stayed at Jalgaon and watched the illnesses and deaths. On marking down in a map the houses where deaths had lately been occurring, it was obvious to him that there was something wrong in a particular part of the town. And the discovery on the 2nd December of a bubo on the body of a dead woman showed him that it was plague that the people had been dying of. So I went to Jalgaon.

The Europeans available when plague became an established fact were Mr. Hatch, Mr. Pogson, Mr. Priestley (of the Police Department), and Messrs. Sibbald and McCarty, Abkari Inspectors. Subsequently, Mr. Firth of the Staff Corps came and rendered valuable assistance till he had to go to Bhusaval to take charge of the new camp there. And still later Dr. Stewart came from Bombay, and is, I am glad to say, with us still.

A Mussalmán member of the Municipality—Mr. Itbárkhan—has behaved excellently, and voluntarily devoted the whole of his time to plague work throughout. Another Municipal Commissioner, Mr. Lahanu (who is also Police Patil), has been doing all in his power to help; and has exercised his great influence most beneficially.

Mr. Hatch and I both agree that the man to have as Mámlatdár in an emergency of this sort was Mr. Karandikar, whose name I have already mentioned favourably to Government. So with the Commissioner's permission, I brought him to Jalgaon, where he has fully satisfied all our expectations. At the same time a number of kárkuns, vaccinators, Abkari sub-inspectors, and so forth, were brought in from the talukas: the town was divided into wards: and search parties assigned to them: the wards again were distributed among European superintendents: and plague cases were searched for. A plague camp and a segregation camp were of course erected. Police were stationed on the roads leading east, south and north to stop any one who had not a pass, and 2nd and 3rd class booking from Jalgaon and the station on either side was stopped in an eastward direction. Going westwards was not forbidden, as it was thought that a certain number of people would be sure to go away and that it was better to give the stream an inclination back towards the infected Bombay Districts than forward towards uninfected Bhusaval and the Central Provinces and Berárs.

The object to be aimed at was to get the townspeople out into the fields as quickly as possible, but not to frighten them so much that they would go beyond the fields and into other villages and infect them. The inhabitants of the infected part had to be taken out in a body: if they went voluntarily so much the better, but go somehow or other they must. Before taking them out, however, a camp had to be run up to receive them. As soon as it was ready, they were all taken out to it. It was thought that perhaps there might be some difficulty in getting them to comprehend why they were to go out. And as it was desirable that whatever was to be done should be done by the people good-humouredly, I asked the two most respected and influential Mussalmán gentlemen in Khándesh—Khán Sáheb Sayad Jamal of Bhadgaon and Khán Sáheb Dáda Miya of Páchora—and a retired Risaldar-Major of Chálisgaon to do me the favour to come in and help in explaining matters to the people, and I am glad to say that, thanks no doubt in great measure to their good influence, the people of the infected part went out cheerfully and without a murmur. The people in the old town—chiefly cultivators—had, in the meantime, following the excellent example of Mr. Lahánu Pátíl (whom I have mentioned above), all gone out into huts in the fields; a number of people in other parts of the town went too, so that in a short time the whole town, except two semi-detached parts and some merchants' shops, was completely emptied. And, on these two semi-detached parts showing signs of infection, the people of them too were turned out, and the shopkeepers were subsequently all removed to a new bazaar organized in a jowari field by Mr. Pogson—whose marked gift of organization has, I may note here, been of the greatest assistance to us throughout this business: so that the town is now—but for the pujaris in a few temples—absolutely deserted. The people are all living in huts in the fields: searching in the town has been given up, as there is no one in it; but sowars, and some European or other, go round the fields every day and make enquiries about sick people.

The disinfection of the town has meantime been pushed on as fast as possible. Labour being unobtainable, I got in a number of pattáhwallas for a short time; but about 100 coolies were then got up from Bombay: and the cleaning of the houses, the opening of the roofs, the washing with perchloride and lime, has made such progress that probably by the end of next week every house in the town will have been done.

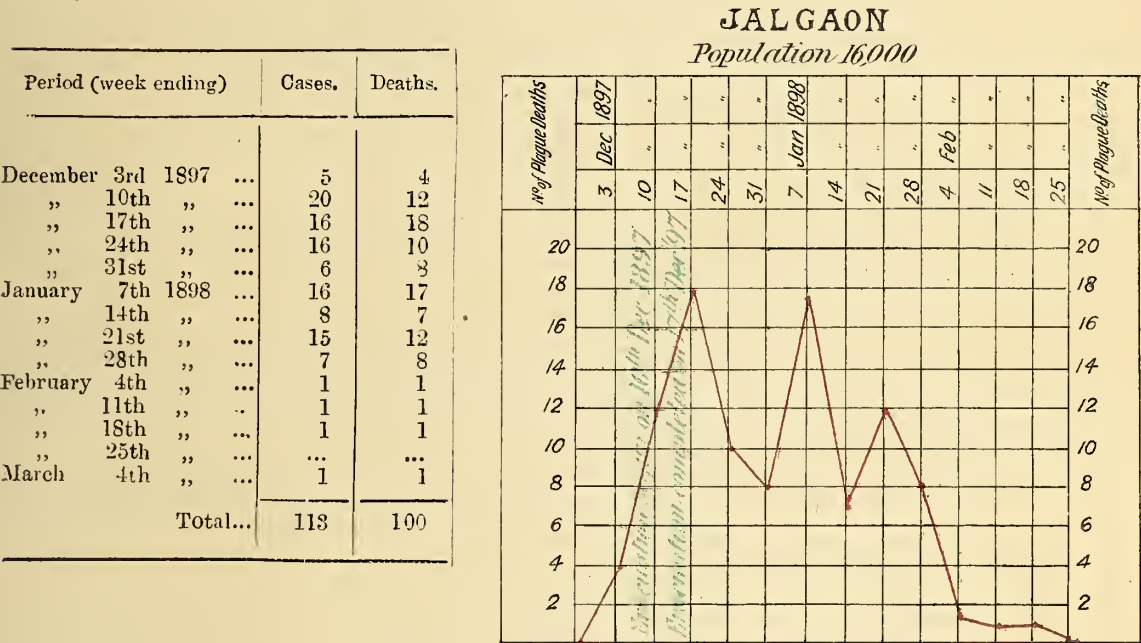
The kárkuns, vaccinators, pattáhwállás, etc., brought in from the tálukas, have been sent back. A couple of special kárkuns have been entertained for the Plague Officer, and a number of extra police have been enlisted to guard the empty town, the roads, the plague and segregation camps, etc.; for sanction for them, I am applying separately.

Everything is being paid for by the Municipality, except the police and the disinfectants.

The parts of the town whose inhabitants the plague has been worst among are the cloth bazaar and the street or two immediately to its north and south. The people principally affected have consequently been Márwádis, and next to them Wánis. Then come the servants of Márwádis and Wánis: chiefly Pardesis, with a Mussalmán or two, and a Kunbi or two. The plague had got amongst two sets of people who work for Márwádis and Wánis, viz., hamáls (Deccanis) and sweepers; but they seem, I am glad to say, to be free now since they went out into huts."

Here, then, were found the ward system, evacuation, disinfection, railway inspection, search parties, and segregation camps all working together. The result was to greatly diminish the violence of the epidemic.

The following statement shews the progress of the epidemic, week by week:—



On the 20th of January 1898, indigenous plague appeared (with two cases) at Neri Khândesh District. (population, 2,200), a village in the Jámner Táluka, and about Population—1,460,851. the same date at Pimprála, a village west of, and close to, Jalgaon. These two villages were at once evacuated. Subsequently another village in the Jalgaon Táluka and four or five in the Jámner Táluka became infected. The disease also appeared in one village of each of the tálukas of Chalisgaon, Amalner and Dhulia.

During the week ending the 28th of January 1898, 7 cases occurred in Jalgaon: the infection in almost every case being clearly traced by the Collector.

During the week ending 31st of January 1898, the numbers were 15 cases—12 deaths in Jalgaon; and the Collector, in an interesting note, endeavours to classify the attacks.

“The fifteen cases may, I think, be arranged under certain heads:—

A.—A Rangari woman and a Wáni woman did not, I should say, die of any

fresh infection from the town ; they died of poison originally carried out by themselves or their relatives when the town was evacuated.

B.—But as regards five other people, their infection has, I think, been derived from the town since the people went out. I mentioned last week a man who had died of plague, the father of a whitewasher, who had also died of plague. That man's wife (the mother of the whitewasher) has in the week under report died of plague (developed like her husband's when under segregation). Another whitewasher has caught it. A sweeper woman, who was assisting in cleaning the town, has caught it. A man, who was helping the merchants to take their goods out of their shops to the new bazaar organized in the fields, caught it. A Pardesi policeman, employed on duty at night in the town, caught it : possibly from lying down to sleep in some empty house.

Again, of the Pujáris that I had allowed to remain in the town to do the worship at the temples, the son and nephew of one caught it : but that it was from *living* in the town—not from rubbing shoulders with some infected worshipper—I cannot say. [Their developing it explained how the Kunbi boy I mentioned last week as working for a Bráhmín, caught it : he was the Pujári's servant.]

Under the same head might perhaps be put—

(1) A Mahárin, who used to sell grass by the roadside near a heap of gunny bags lately removed from the town and put in the open to be disinfected by the sun.

(2) A Teli girl, who died suddenly : cause unknown, but put down as plague because her grandfather had recently had fever of some sort and died.

Neither case was clear, as the grandfather was an old man, and she did not come to Jalgaon till after his death. But if it was plague they died of, then the infection may possibly have come from some Teli who has got permission to go into the town for some hours in the day to work his oil-mill. [This is now being stopped, and oil-mills removed outside the town.]

C.—A twelfth case was that of a very poor man, practically a beggar : a man who used to scrape up from the ground (for food) the grains that fell at the Wánis' shops as the corn was being measured. A man who lives in this way may contract the infection at any place any time.

D.—The thirteenth and fourteenth cases were a cloth-packer in the weaving mill, and a Kunbi in a threshing floor close to the town. How they got the infection I have not been able to trace.

The fifteenth case was that of a clerk in the Post Office. But though we have counted it as plague, and segregated him and the establishment, and moved the office to another building, I cannot help thinking that it is only malaria : as last month the man was in the extremely feverish climate of the Nawápur Peta.

The plague would appear to have now left the Márwádís and to be leaving the Wánís and Pardesís—the three classes who suffered so severely from it at first. The people attacked in the week under report included Mussalmáns, Bráhmíns, a Kunbi, a Marátha, a Weaver, a Mahárin, a Jain Shimpi, a Teli, a Sweeper : so that it cannot be to have gone into any said one particular class. Nor has it gone into any one particular part of the fields."

The disinfection of the whole town with perchloride of mercury having been completed during this week, the coolies from Bombay were sent back there.

On the 1st of March 1898, plague appeared at Pilkhod (Chálisgaon Táluka). Pilkhod had, owing to some suspicious deaths, been previously evacuated in January : but, owing to a violent storm, it was soon after re-occupied. "It is impossible," writes the Collector, "to say where the infection came from." On the 4th of March 1898, two fresh villages—Málpimpri and Samrod (population, 1,000) (both in the Jámner Táluka)—were attacked ; but the source of infection could not be discovered.

The following statement shows the gradual spread, with the source of infection where known:—

Táluka.	Villages.	Date of first reported cases.	Source of infection.
Jalgaon	Jalgaon	10th December 1897 ...	Sholápur (probably).
Do.	Pimprála	4th February 1898 ...	Jalgaon.
Jámner	Neri	4th February 1898 ...	Do.
Jálgaon	Bholána	11th February 1898 ...	Unknown.
Jámner	Neridigar	11th February 1898 ...	Do.
Do.	Talegaon	25th February 1898 ...	Do.
Chálisgaon	Pilkhod	4th March 1898 ..	Do.
Jámner	Málpimpri	11th March 1898 ...	Do.
Do.	Samrod	11th March 1898 ...	Do.
Amalner	Nagaum Khurd ..	15th March 1898 ...	Do.
Jámner	Shelgaon	18th March 1898 ...	Do.
Dhulia	Shirud	22nd March 1898 ...	Do.

Each of these villages, as soon as indigenous plague was discovered in it, was at once completely evacuated and disinfected.

The following table shows the number of cases in the District and in Jalgaon Town during the successive months of the epidemic, together with the number of villages infected:—

Month.	Number of villages infected.	KHANDESH DISTRICT (excluding Jalgaon Town).		JALGAON TOWN.	
		Cases.	Deaths.	Cases.	Deaths.
October 1896 to December 1897.	...	*40	*18	...	...
December 1897 ... ..	...	5	4	63	52
January 1898	1	5	4	46	44
February 1898	4	74	61	3	3
March 1898	11	117	90	1	1
April 1898	4	15	14	...	...
Total ...	...	256	191	113	100

* All imported.

From the 22nd April 1898 no case occurred till December 1898, when the disease appeared in a village adjoining one of those infected in the previous fair weather, and resulted in 25 cases—21 deaths during the week ending 16th December 1898. The returns for the following week were blank.

Since January 1899 plague again appeared and spread in Khandesh District. During the week ending January the 6th there were 35 cases and 27 deaths; and during the succeeding weeks the figures rose steadily until the first week in March, when 73 cases—49 deaths were recorded.

These were the highest figures reached in the epidemic, and the next week showed a decrease. Steadily the disease was got under control, until, for the week ending 5th May the returns were blank. May, June, and July continued free, but towards the end of August and in September and October plague again appeared, 166 cases—133 deaths in all being reported.

The following are the monthly figures from January to November 1899 :—

Month.	Cases.	Deaths.
January 1899 —4 weeks ..	142	108
February „ —4 „ ..	163	146
March „ —5 „ ...	242	197
April „ —4 „ ..	100	64
May „ —4 „ ...	1	...
June „ —5 „ ...	2	2
July „ —4 „ ...	...	...
August „ —4 „ ..	56	31
September „ —5 „ ...	102	94
October „ —4 „ ...	8	8
November „ —4 „ ...	...	...
Total...	816	650

NASIK DISTRICT.

Area...	...	...	...	...	...	5,940 sq. miles.
Population in 1891	...	...	...	...	...	843,582.
Density of population	...	...	...	...	...	142 per sq. mile.
Rainfall	...	...	...	...	...	About 58 inches.

Rhomboidal in shape, with a length of 108 miles from north-east to south-west, and an extreme breadth from north to south of 87 miles, the Násik District is bounded on the north by Khándesh; on the east by the Nizam's dominions; on the south by the Ahmednagar District; and on the west by Thana, the State of Dharampur, and the Songad division of the Gaekwar's territory.

The climate varies considerably in different parts of the District, the extremes of heat and cold being greater towards the east. For a short period in each year extreme cold and extreme heat are experienced, the extreme cold usually in January, and the extreme heat in the beginning of April. Occasionally in May, the thermometer rises to 102°, and during exceptionally cold weather in December and the early part of January, it has been known to fall as low as 27°. Násik is one of the healthiest districts in Western India. The rainfall is heavy in the hill-tracts in the west, moderate in the centre, and uncertain and scanty in the east.

With regard to the soil, little need be said in a geological point of view. The valleys are filled with disintegrated basalt of various shades, from grey to black, washed down by rain. It is of an argillaceous nature, and its colour depends greatly upon the organic matter it has imbibed, or the length of time it has been exposed to the air. The red soil is less common and more tenacious than in most districts.

There is no authentic record of plague in Násik District previous to 1896.*

First Epidemic (July 1897—March 1898).—Imported cases of plague were discovered in this District as early as December 1896, and from that date to the middle of May 1897 forty-seven such cases occurred in different parts of the district. No further case was observed up to the end of July.

Plague in the
Násik District.
December 1896 to
March 1898.

At this time it was rumoured that plague existed at Igatpuri, an important town situated on the G. I. P. Railway, 28 miles from Násik, in the direction of Bombay. The Collector at once visited the town with Major A. V. Anderson, I. M. S., and from the inquiries they instituted, it was ascertained that plague really existed, and that cases had been occurring for about a fortnight previous to their visit. Indigenous plague may, therefore, be said to have commenced in the district towards the latter part of July 1897. The infection is attributed to two cases imported from Bombay.

It was remarkable that, in spite of the comparatively large number of imported cases which occurred in the District, indigenous plague did not show itself for a long time,—especially in the town of Násik, where as many as 36 imported cases—26 from Igatpuri alone—were discovered before the first indigenous case occurred on 12th October 1897. The Civil Surgeon, Dr. Maynard, comments on these facts as follows:—

* *Bombay Gazetteer*, Vol. XVI.

"The above facts, at least as far as Násik is concerned, show a peculiarity as regards this epidemic, *viz.*, that no less than 26* cases of a virulent type of the disease (these cases showed a mortality of 92·73 per cent.), nearly all in the same quarter of the town (Kájipura and its vicinity), in which the conditions seemed to be peculiarly favourable for its becoming indigenous, occurred before one of the local residents contracted the disease."

* Dr. Maynard refers to the number of cases subsequent to the 13th August 1897.

With Igatpuri infected, however, it was no longer possible to ward off an outbreak, and several places in the Táluka, including Deoláli, Nándgaon, and Ghoti, as well as Ambe in the Dindori Táluka and Khede in the Niphád Táluka, were soon infected, with the result that during the months of August and September 1897, 393 attacks and 309 deaths were reported.

The next place of importance attacked was Manmád, but the infection is stated to be due to an arrival from Sirúr in the Poona District, which at the time was infected.

The epidemic, which had so long menaced Násik Town itself, at last broke out, and the first case, which was discovered on 12th October 1897, is thus referred to by Dr. Maynard :—

"The first case in which exposure to infection by the patient had not occurred outside Násik Town was that of a Mussalmán, who, on the 12th October 1897, was found to be suffering from plague in a house in the same part of the town in which most of the imported cases had been found; and which afterwards furnished the greatest number of local cases, and was the first to be vacated. This house was found to have been also occupied just previously by seven people who had come direct from Igatpuri. These people had stayed in the house for a few days, when one of their number was taken ill; and they returned at once to Igatpuri, where the one taken ill died."

The manner of dissemination was obscure; but in Dr. Maynard's opinion rats were apparently closely connected with it—

"As bearing on the question it may be stated that on the two days immediately preceding the discovery of the first local case, about a dozen dead rats were found in the immediate vicinity of the house in which it occurred. It is unfortunate that no material was available by which a bacteriological examination of these dead rats could be made. The local cases were at first confined to that part of the town in which the first one occurred, a quarter consisting chiefly of small dark grass-roofed huts inhabited by poor Mahomedans. In a great many cases the source of infection could be directly traced to another cause."

During this month Sinnar also had to be added to the list of infected places, and the returns number 197 cases and 164 deaths.

The early measures adopted throughout the District are thus described by the Collector :—

"In March 1897, Hospital Assistants were deputed to Igatpuri, Manmad, and Násik Road Stations to examine passengers, and additional police were sent there to assist them. Isolation sheds were erected at several places, and orders were issued to the Mámlatdárs to make strict enquiries in every village into the cause of death, especially where there was an allegation of fever. Comparison of death statistics was directed to be made in large towns, and village plague authorities were appointed throughout the district. The Station Master at the Násik Road Station was directed to make such arrangements on the station as would make passengers alighting on it pass out by such exits as the Civil Surgeon prescribed for facilitating medical inspection. Nos. 6 and 7 of the plague rules were applied to the towns of Násik, Igatpuri, Málegaon, Manmád, Nándgaon, Yeola, and Trimbak."

These measures were gradually supplemented by others, and from about the end of October 1897 the measures actively employed to combat the disease were—

- (1) An isolated plague hospital.
- (2) Health and segregation camps for contacts.
- (3) Observation camps for suspects.
- (4) Disinfection of houses (either infected or in close proximity to such).
- (5) Evacuation.

- (6) Defence of the roads leading into the town by ten days' detention for arrivals from infected places, and surveillance of new arrivals.
- (7) The ward system.
- (8) Corpse inspection.

In addition to these, Railway Camps were established at Mámmad, Igatpuri, and Násik Road.

The Observation Camp at Yeola must be noticed ; the Collector says—

“ An observation camp on a small scale was maintained at Yeola by the Municipality from the 12th December 1897 to 30th April 1898. There were from first to last 315 admissions from infected places. ‘Ten days’ detention was enforced, and the detained were, with their belongings, disinfected on arrival. Not a single case of plague occurred in the camp, and the Hospital Assistant attributes this to the thoroughness of the disinfection. There was a difficulty in discriminating and providing for the indigent during detention. The evidence is, of course, negative, but a share of the credit, for immunity of Yeola during 1897-98, may, I think, be fairly claimed by the authorities who organized and worked the detention camp.”

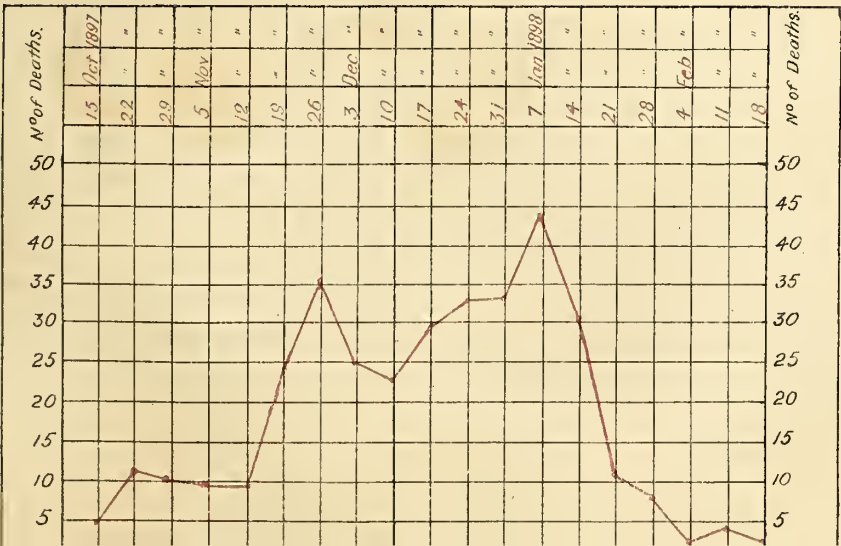
These measures were applied more or less thoroughly throughout the District.

In Násik Town these measures were introduced within a week or two of the occurrence of the first case, with the exception of evacuation and the ward system. Evacuation was begun by streets about the 1st of November 1897. But it was soon seen that the evacuation of one or two houses was wholly insufficient to check the spread. The evacuation of whole blocks therefore took its place from about the 11th of November 1897; and was so thoroughly carried out, that by the 10th of January 1898 $1\frac{1}{2}$ ths of the town lay empty. That this was the measure which principally checked the epidemic will be seen from the following figures :—

Násik Town
Population—24,429.

Month.	Population by Census of 1891.	Cases.	Deaths.	REMARKS.
October (5 weeks)	24,429	52	38	The figures for October are only approximate, and include 7 imported cases and 2 deaths.
November (4 weeks)		137	106	
December (5 weeks)		186	147	The figures for the first two weeks of November are only approximate.
Total ... ..	.....	375	291	3 months previous to evacuation.

NASIK TOWN
Population 24,429.



January's figures are sufficiently instructive to be given in weekly detail :—

Week ending			Cases.	Deaths.	Remarks.
7th January 1898	...	...	49	45	
14th January 1898	...	...	32	32	
21st January 1898	...	...	18	12	
28th January 1898	...	...	7	9	
Total for January 1898			106	98	
February 1898 (4 weeks)	...	...	18	15	
March 1898 (4 weeks)	...	...	20	12	
April 1898 (5 weeks)	...	...	1	1	
Total			145	126	4 months subsequent to evacuation.

By the 22nd December 1897 the west and south portions of the town lay empty. In that week the disease appeared amongst the Bráhmíns : whereupon the Dingerali block near the river was vacated during the following week.

Coolies were sent from Bombay to assist in the work of disinfection.

Mr. Stewart says :—

“ We have nine disinfecting parties at work, and are putting on two more, as, there seems no doubt the whole town must be disinfected.”

On the 29th December Mr. Stewart reports :—

“ There has been an increase of three cases over last week, though two days during the week were bad, showing twelve and nine cases. These nearly all occurred in the thickly populated centre of the town, and some half dozen cases were members of three or four households related to one another. I have now ordered six more blocks covering this portion to be vacated, and am making every effort to get the people to live in the health camp instead of going to villages round about. A circular has been sent to all village officers that they will be strictly held responsible if they allow plague to enter their villages.”

The Bombay coolies were sent back on the 6th January 1898, their work being unsatisfactory : and local labour replaced them. “ Almost the whole city is empty,” writes Mr. Stewart on the 10th January 1898, “ even those blocks which have not been formally emptied having very few inhabitants.” During the week ending the 13th January 1898 a decrease took place, but Mr. Stewart was sceptical :—

“ There has been an appreciable decrease in the number,” he writes “ (31 against 49), though I should not like to say that we have got control of the plague . . . and I am not satisfied that we are getting all the cases that occur amongst the people in the fields.”

And indeed no less than 9 dead bodies were found. The following week, although the decrease continued, it was the same complaint :—

“ The city is practically free of plague, and disinfection of entire blocks is being steadily pushed on. I am not satisfied, however, about the people in the fields. Of the 7 cases reported, 5 were found dead, and more outside inspection than we can manage seems needed.”

This end was ultimately compassed by detailing a Superintendent and a Hospital Assistant to visit outlying camps daily : a measure which was instituted the following week.

As the evacuation of the town was practically complete by the middle of January 1898, it is perhaps not unreasonable to infer that the sudden subsidence of the epidemic was largely due to that measure, especially if it be taken in conjunction with other towns, which, under similar circumstances, present the same phenomena.

In the District, inclusive of the figures quoted in the tables above, there were 61 cases and 467 deaths in the months of November and December, and 568 cases with 48 deaths in January and February 1898. There was an appreciable reduction in March —

210 cases, 167 deaths—and then a sudden decline. By the middle of April the District was practically free from plague and a blank report was submitted for the week ending 13th May 1898, the total number of cases during these 2 months being 35, and deaths 28.

As a proof of the belief of the people in the efficacy of evacuation, may be noted that a great many left their houses to camp in the jungle without in any way being compelled to do so. In the same connection also, Dr. Maynard states :—

“Taking the experience of Násik Town with the villages of the District in which the epidemic appeared, the preventive measure as regards the spread of the disease, which seems to be of by far the greatest value, is the vacation of the whole of the houses, with control of the people in properly-arranged camps on selected sites, with thorough disinfection of all the houses in which cases have occurred, as well as those in their immediate vicinity, combined with all possible improvements in general sanitation.”

It is worthy of mention that the G. I. P. Railway Company set aside 150 empty wagons for the use of their native employé's at Igatpuri. The result is declared to have been in the highest degree beneficial. From five to seven hundred people were comfortably accommodated in the wagons at the time when the epidemic was at its height, and not a single case of plague occurred among them.

Re-occupation of the town by blocks was permitted from the 16th of February 1898, and by the middle of April the whole town was thrown open. Elsewhere, too, re-entry was allowed generally within a month or so after the disappearance of plague. But the majority of the people were apparently not eager to re-enter it, as they remained in camp till the approach of the rains.

One of the worst affected places in the Násik District was Malegaon—a town not only important in itself, but practically the gate of the yet unstricken District of Khandesh. It has a considerable population, numbering about 15,502, who maintain constant intercourse with the surrounding country, more especially with Násik on the one side and Dhulia and Chalisgaon on the other.

Freedom from imported plague could, under the circumstances, hardly be hoped for : which, indeed, began to occur as early as January or February 1897. But the authorities were on the alert and took prompt measures to segregate such cases. After the rains of 1897, Mr. A. H. A. Simcox, I. C. S., Assistant Collector, organized systematic preventive measures and had the Girna bridge and the fords of the Girna river as well as the Municipality closely watched. He called in the aid of the Municipal Commissioners, and succeeded in establishing house-to-house inspection. But the town had no natural barriers, and with a limited establishment it was impossible to detect each and every person entering it. An old woman from Bombay evaded the guard, entered the town and developed plague. The case was, indeed, detected on November 12th, but the infection had already been communicated.

Next day, Mr. Simcox arrived and found that measures had already been taken in hand. A rest-house was turned into a hospital, a godown into a segregation camp, and a block of houses was evacuated. Disinfection with fire and chemicals was started, while a good many people left the town. The week's record numbered 9 cases and 6 deaths : in the following week there were 7 cases and 5 deaths, and in the week ending 3rd December 1897, the number of cases was further reduced to 4, of which 3 proved fatal. Every hope was entertained that the epidemic was nipped in the bud. In the meanwhile, an English Doctor had arrived, and a Commission, consisting of Mr. Wingate, Surgeon-General

Cleghorn, and Colonel Hay, I. M. S., visited the town, and expressed satisfaction with the arrangements.

Among the people who were turned out of the infected block were certain Kunbis who went into their fields. These people stealthily visited the infected quarters and kept the plague alive amongst the evacuated population. The result was a re-introduction of the disease into the town by their means. It was now necessary to carry out measures on a much larger scale. Accordingly, groups of huts for a Hospital and a Health Camp were built on an excellent plan outside the town and large numbers of people vacated their houses. In December a Staff Corps Officer arrived, while the Staff was augmented by an Assistant Surgeon, 2 or 3 Hospital Assistants, an Abkari Inspector and a Municipal Sanitary Inspector. Miss Clark and Miss Fulcher of the Zenana Mission voluntarily rendered the greatest assistance at the hospital.

But the disease scarcely seemed to yield, as the following figures will show :—

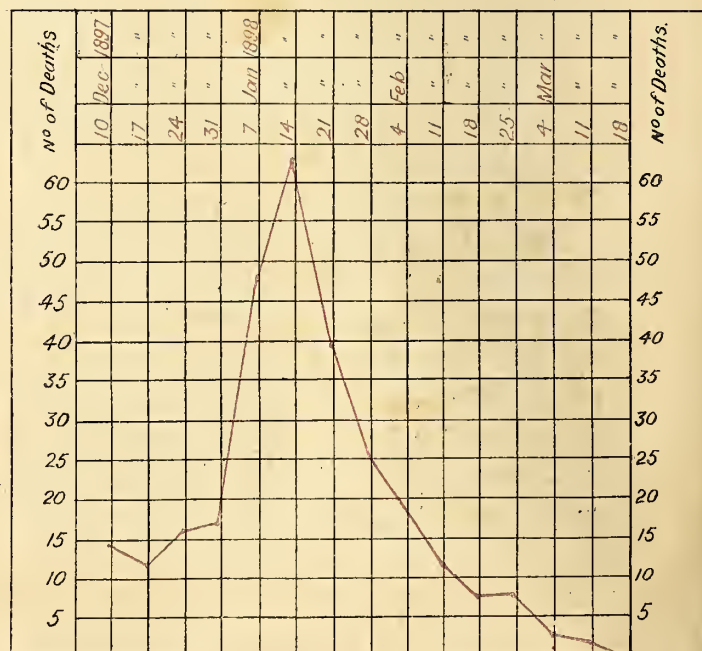
Week ending	Cases.	Deaths.
10th December 1897 ...	21	16
17th do. ...	19	13
24th do. ...	24	17
31st do. ...	26	18
7th January 1898 ...	63	48
14th do. ...	70	62
Total ...	231	174

The Hospital and Camp had already outgrown their former size, but were not yet large enough to accommodate the number requiring admission. The Camp was therefore rapidly enlarged and the whole remaining population transferred thither. The public offices were shifted to the vicinity of the Camp, and a Post Office was also set up there. The weavers had special sheds constructed for them in which they erected their looms. Thus the town was entirely deserted, or rather a new temporary town was created in its vicinity. Meanwhile systematic disinfection was carried out in the town. By the first week of February the town lay empty, and the effect of the measures was highly salutary, the figures diminishing rapidly. The following statement shows the figures after the 14th January when the zenith was reached :—

MALEGAON

Population 15,502.

Week ending.	Cases.	Deaths.
21st January 1898 ...	50	41
28th do. ...	29	27
4th February 1898	27	20
11th do. ...	12	13
18th do. ...	10	9
25th do. ...	11	9
4th March 1898 ...	2	4
11th do. ...	4	3
18th do. ...	1	...
Total ...	146	126



The following incident is related. On the 9th February there was a heavy storm. "The people," says Mr. Simcox, "came *en masse* to my bungalow and threatened me, and I was down at the Health Camp for some five hours with the other officers and gentlemen arguing with the angry mob, and even so had to leave them without coming to any definite arrangement, though at least a riot was averted." The final arrangement made was that the weaving men should be allowed to weave in their town workshops by day, sleeping in the Health Camp, where all drying and stretching of thread, and household work, was still to be done. This arrangement was successful and prevented a fresh outbreak, which would probably have occurred as at other places, had the people been allowed to re-occupy the town. The partial re-occupation had also another effect, *viz.*, that of testing the efficacy of the disinfection. On the 23rd March 1898, re-occupation of the town was permitted and was not attended with a single case of plague.

Second Epidemic (August 1898—May 1899).—After being entirely free for over two months and a half, Násik District was again affected towards the beginning of August 1898, and during the week ending the 5th of that month, 22 cases were reported from Vinchur in the Niphád Táluka, and 5 cases from Anjanneri in the Násik Táluka. Neither of these places was infected during the previous epidemic; nor is the origin of the outbreak at Vinchur traceable; the infection of Anjanneri is attributed to intercourse with the Konkan. Next week 23 cases were reported; but in the succeeding weeks the circle of infection grew wider and the number of attacks increased, until, with 9 places stricken, it reached the total of 176 in the week ending 16th September 1898; and with 15 infected places, 203 in the week ending 14th October 1898.

Almost at the beginning of this epidemic, strict instructions had been issued by the Collector, Mr. Moore, to the effect that as soon as 2 cases occurred in a village, it should at once be evacuated. The inhabitants were ordered to reside in huts in the village fields. Disinfection was secured by unroofing houses and leaving them open (the doors and windows being barred with bamboos to prevent ingress), and exposing their contents to the sun for 3 days. If any cases occurred in huts, they were pulled down and the materials allowed to be used after exposure to the sun, but the site of the hut was not permitted to be built upon again. A careful system of death registration was also set on foot.

The season, however, did not permit of thorough evacuation, and it could only be resorted to on a regular scale about the beginning of November. Both townsmen and villagers quitted their homes and lived in the fields, and were only allowed ingress on business: shopkeepers attended by day, but slept in the fields, and the towns were guarded by night patrols. It was then that the weekly returns improved, and in the week ending 18th November, only 30 cases were reported. At this time some dead rats having been found in the village of Khadak Málegaon, Táluka Niphád, the villagers promptly turned out into the fields of their own accord and the place remained free. Though the figures were slightly worse in the subsequent weeks, this was due to infection of fresh places.

Several villages were now declared free and were re-occupied in January 1899, but the disquieting feature was the danger to Násik Town, through imported cases, which continued to occur there from time to time. In spite of all precautions, 4 indigenous cases, all fatal, took place in the week ending 20th January 1899. The number rose steadily, and in the week ending 31st March 54 cases were recorded out of a total of 69 in the district. It has since been declining, and the report for the week ending 2nd June 1899 shows 11 attacks. It is satisfactory to note that besides these cases in Násik Town, only 1 case was returned from the District during that week.

Though a large number of the places stricken during the first epidemic remained free on the second occasion, all the important towns were attacked a second time. The infection, wherever traceable, appears to have been due to importation, and there is no history of a true recrudescence. The following are the monthly figures for the second epidemic:—

Month.								NÁSÍK DISTRICT. Population— 843,582.		NÁSÍK TOWN. Population— 24,429.	
								Cases.	Deaths.	Cases.	Deaths.
August	1898,	4 weeks	...	...	...	...	...	212	155	...	...
September	"	5 "	...	...	...	...	...	717	535	...	...
October	"	4 "	...	...	...	...	...	563	352	...	...
November	"	4 "	...	...	...	...	...	191	123	...	...
December	"	5 "	...	...	...	...	...	210	170	...	...
January	1899,	4 "	...	...	...	...	...	107	96	18	13
February	"	4 "	...	...	...	...	...	266	211	85	70
March	"	5 "	...	...	...	...	...	409	335	219	169
April	"	4 "	...	...	...	...	...	150	134	111	98
May	"	4 "	...	...	...	...	...	98	98	46	40
Total ...								2,923	2,189	479	390

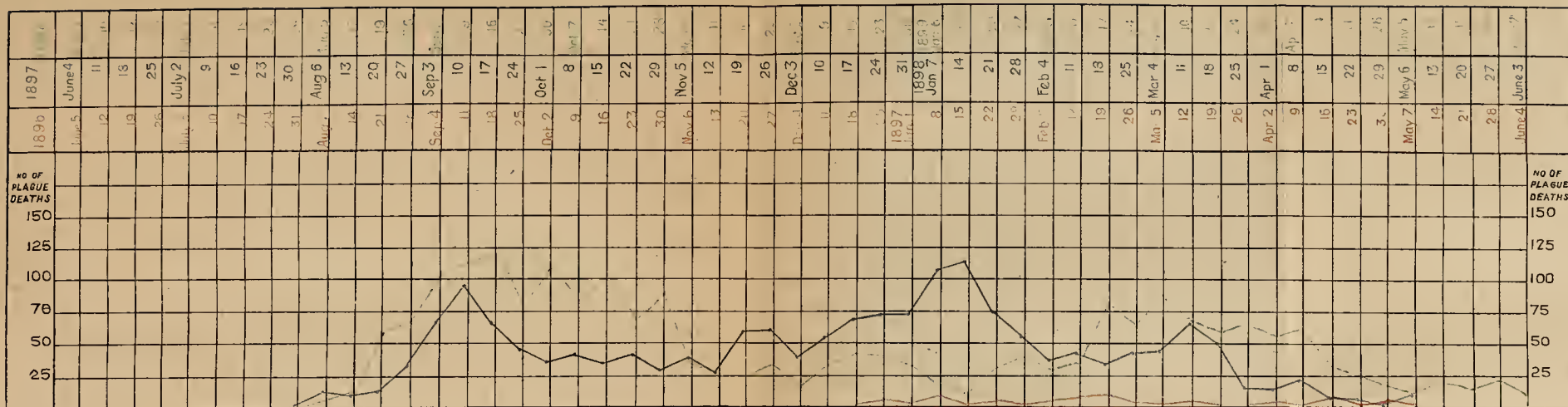
The figures for the month of May 1899 and two weeks of June were encouraging enough, but by the end of June it was clear from the returns that the Násík District was doomed to suffer still another epidemic, which has eclipsed in virulence, if not in duration, the one preceding it. Through July 1899 a steady increase took place, but with the advent of August the rise became much more rapid. The returns for the fourth week of September were 1,051 cases—805 deaths, the figures for the whole month being 4,345 cases—3,268 deaths. Thereafter the disease rapidly declined, and at the present time (November) has almost wholly subsided.

Over 90 places were attacked throughout the whole District; the monthly figures for the whole District being:—

Month.				Cases .	Deaths.	REMARKS.
June	1899	...	...	129	111	
July	"	...	..	714	661	
August	"	...	...	1,908	1,460	
September	"	...	...	4,345	3,268	
October	"	...	...	2,316	1,882	

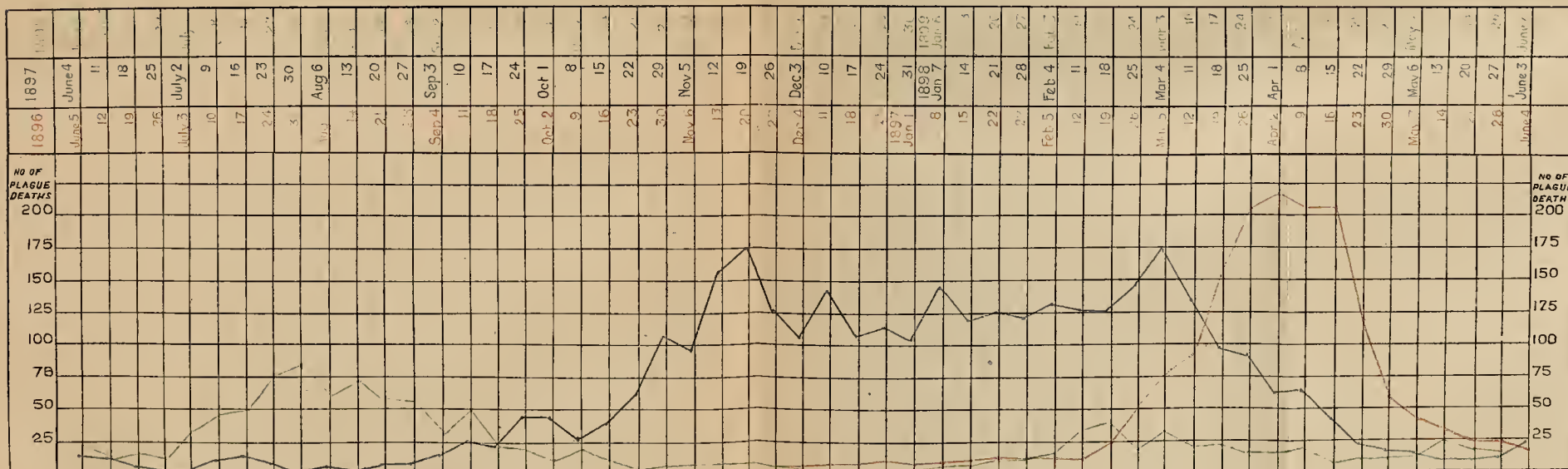
NASIK DISTRICT.

Chart showing Plague Mortality.



SURAT DISTRICT.

Chart showing Plague Mortality.



BALUCHISTAN
SHIKARPUR
UPPER SIND FRONTIER
Sukker
KARACHI
HYDERABAD
THAR & PARKAR

MAP OF THE BOMBAY PRESIDENCY

ILLUSTRATING THE EXTENT AND INTENSITY
OF THE PLAGUE

Sept. 1896—June 1897.

Scale 1 inch=80 Miles



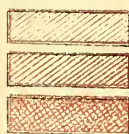
REFERENCES

Districts and States in which the number of reported
plague seizures per 100,000 of the population was

from:— 1 to 100

101 to 500

501 to 1000



No. I (a)

1898-99.

Serial Number.	Place.	District.	Population.	Duration of Epidemic		Cases.	Deaths.	Percentage of Mortality on Population
				From	To			
1	Bombay	Thana	806,144	June 1898 ..	June 1899 ...	19,139	15,700	1·
2	Poona	Poona... ..	161,696	February 1899 ...	June 1899 ...	1,112	1,028	0·
3	Karachi	Karachi	97,009	February 1899 ...	June 1899 ...	2,982	2,156	2
4	Hubli	Dharwar	52,194	June 1898 ...	November 1898 ...	3,440	2,913	5·
5	Mandvi	Cutch... ..	38,155	February 1899 ...	June 1899 ..	1,636	1,253	3·
6	Dharwar	Dharwar	32,533	June 1898 ...	November 1898 ...	1,261	900	2·
7	Belgaum	Belgaum	28,342	July 1898 ...	December 1898 ...	2,687	2,006	7·
8	Miraj	Kolhapur & S. M. C.	26,060	September 1898 ...	February 1899 ...	1,355	1,211	4·
9	Sangli	Do.	14,793	June 1898 ...	May 1899 ...	936	769	5·
10	Godhra	Fanch Mahals ...	14,691	December 1898 ...	May 1899 ..	744	523	3·
11	Bhiwadi	Thana	14,387	May 1898 ...	October 1898 ...	1,771	1,245	8·
12	Shahapur	Kolhapur & S. M. C.	12,046	June 1898 ...	May 1899 ...	945	765	6·
13	Bail Hongal	Belgaum	9,428	September 1898 ...	December 1898 ...	1,626	1,311	13·
14	Bantwa	Kathiawar	8,641	July 1898 ...	November 1898 ...	933	599	7·
15	Dodwad	Kolhapur & S. M. C.	4,446	January 1899 ...	April 1899 ...	262	184	4·
16	Gundiali	Cutch... ..	4,280	September 1898 ...	October 1898 ...	171	136	3·
17	Shelwadi	Dharwar	4,222	October 1898 ...	December 1898 ...	1,376	1,154	27·
18	Kundgol	Kolhapur & S. M. C.	4,156	October 1898 ...	January 1899 ...	560	89	9·
19	Savshi	Do.	4,075	October 1898 ...	February 1899 ..	735	578	14·
20	Byahatti	Dharwar	3,589	September 1898 ...	December 1898 ...	1,097	782	21·
21	Sulebhavi	Kolhapur & S. M. C.	3,083	August 1898 ...	December 1898 ...	377	575	8
22	Wategaon	Do.	3,108	August 1898 ..	January 1899 ...	282	207	6
23	Old Belgaum	Do.	2,799	September 1898 ...	January 1899 ...	211	174	6
24	Ingalhalli	Dharwar	2,203	August 1898 ...	November 1898 ...	1,048	807	36
25	Pur	Kolhapur & S. M. C.	1,936	September 1898 ...	February 1899 ...	388	273	13
26	Khidrapur	Do.	1,888	May 1898 ..	August 1898 ...	264	229	12·12
27	Malapur	Dharwar	1,816	October 1898 ...	December 1898 ...	664	545	30·01
28	Helge	Kolhapur & S. M. C.	1,786	September 1898 ...	November 1898 ...	312	284	15·91
29	Ibrampur	Dharwar	1,692	October 1898 ...	December 1898 ...	869	610	36·05
30	Adargunchi	Kolhapur & S. M. C.	1,606	August 1898 ...	October 1898 ...	453	311	19·36
31	Betdur	Do.	1,567	September 1898 ..	November 1898 ...	257	174	11·10
32	Karnal	Do.	1,467	June 1898 ...	August 1898 ...	165	125	8·52
33	Bhandwad	Dharwar	1,306	August 1898 ...	October 1898 ...	501	482	36·90
34	Datanhol	Do.	1,280	October 1898 ...	November 1898 ...	554	432	33·75
35	Machhe	Kolhapur & S. M. C.	1,230	August 1898 ...	September 1898 ...	109	95	7·72
36	Umachigi	Dharwar	1,162	August 1898 ...	October 1898 ...	332	328	28·22
37	Bhairdevkop	Do.	994	September 1898 ...	October 1898 ...	167	155	15·53
38	Hiregunjal	Kolhapur & S. M. C.	943	October 1898 ...	January 1899 ...	164	113	11·97
39	Konheri	Do.	878	August 1898 ...	November 1898 ...	115	90	10·25
40	Devnur	Do.	839	October 1898 ...	December 1898 ...	102	77	9·13
41	Kadpatti	Do.	612	October 1898 ...	November 1898 ...	163	104	15·35
42	Kadalwad	Do.	534	October 1898 ...	December 1898 ...	106	92	17·23
43	Holje	Do.	472	October 1898 ...	November 1898 ...	128	141	29·87
44	Allapur	Do.	358	September 1898 ...	November 1898	178	109	30·44

Date.	Bombay Presidency (as a whole), City. Population in 1891. 25,334,607.5		Bombay City. Population in 1891 819,000.		Northern Division. Population in 1891 3,917,777.		Central Division. Population in 1891 6,237,666.		Southern Division. Population in 1891 5,008,063.		Sind. Population in 1891 2,871,774.		Cutch. Population in 1891 558,415.		Kathiawar. Population in 1891 2,752,404.		Kolhapur and S. M. C. C. Population in 1891 1,562,029.		Other States (Palanpur, Rewa Kantha, Savantvadi, Akal- kot, Anand, Bhor, Janjira & Sachin States). Population in 1891 1,607,479.		Baroda.	References.
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.		
1896.																						
September.	153	96	153	96	153	96	153	96	153	96	153	96	153	96	153	96	153	96	153	96	...	
October.	389	277	389	277	389	277	389	277	389	277	389	277	389	277	389	277	389	277	389	277	...	
November.	333	301	333	301	333	301	333	301	333	301	333	301	333	301	333	301	333	301	333	301	...	
December.	1,861	1,328	1,655	1,160	89	65	50	40	26	25	41	38	...	...	...	...	...	...	...	...	...
1897.																						
January.	4,036	3,239	2,374	1,835	457	341	246	191	93	88	823	751	...	...	...	...	...	...	...	...	...
February.	6,244	5,586	3,172	3,072	1,130	885	331	261	179	155	1,244	1,090	...	...	...	...	...	...	...	...	...
March.	7,669	6,200	2,495	2,266	1,976	1,626	1,171	815	195	155	1,399	1,040	...	...	...	...	...	...	...	...	...
April.	8,956	7,105	1,418	1,277	2,607	2,077	1,688	775	704	665	2,010	1,453	...	...	...	...	...	...	...	...	...
May.	5,304	4,511	448	328	493	406	108	87	331	281	445	342	...	...	...	...	...	...	...	...	...
June.	1,325	1,087	186	99	82	60	23	18	66	58	74	53	...	...	...	...	...	...	...	...	...
July.	683	451	62	44	74	35	258	154	26	21	15	13	...	...	...	...	...	...	...	...	...
August.	2,203	1,490	124	70	59	41	1,712	1,178	28	19	...	...	...	...	...	...	...	...	...	...	...
September.	4,480	3,214	221	163	266	181	3,155	2,220	87	69	...	...	...	...	...	...	...	...	...	...	...
October.	8,939	6,008	264	165	532	329	6,393	5,168	72	56	...	...	...	...	...	...	...	...	...	...	...
November.	10,533	8,263	331	225	889	578	7,982	6,434	275	211	59	42	...	...	...	...	...	...	...	...	...
December.	10,216	8,231	868	638	869	639	6,959	5,760	436	385	29	20	...	...	...	...	...	...	...	...	...
1898.																						
January.	7,636	6,537	2,532	2,515	714	582	2,666	2,136	471	399	8	5	...	...	...	...	...	...	...	...	...
February.	8,951	7,902	4,591	4,464	838	643	1,607	1,301	458	382	...	...	...	...	...	...	...	...	...	...	...
March.	8,635	8,090	4,484	4,713	822	708	1,016	803	610	487	...	...	...	...	...	...	...	...	...	...	...
April.	6,847	5,527	3,403	2,851	726	567	339	241	544	474	718	479	...	...	...	...	...	...	...	...	...
May.	4,331	3,284	816	514	335	247	142	117	192	165	2,212	1,791	...	...	...	...	...	...	...	...	...
June.	1,886	1,314	329	148	219	148	69	57	287	224	510	385	...	...	...	...	...	...	...	...	...
July.	4,834	3,441	422	289	1,288	786	307	266	1,607	1,208	111	82	...	...	...	...	...	...	...	...	...
August.	9,385	7,045	481	444	1,640	927	695	665	4,425	3,409	61	41	...	...	...	...	...	...	...	...	...
September.	20,718	15,438	1,072	802	871	671	2,531	1,858	11,270	8,689	32	18	...	...	...	...	...	...	...	...	...
October.	24,907	18,591	830	676	305	253	3,677	2,861	15,838	11,546	18	12	...	...	...	...	...	...	...	...	...
November.	21,241	16,691	270	208	305	225	3,677	2,861	14,422	11,394	13	11	...	...	...	...	...	...	...	...	...
December.	16,276	13,159	595	487	766	606	3,038	2,474	9,978	8,225	7	4	...	...	...	...	...	...	...	...	...
1899.																						
January.	9,915	8,043	1,545	1,298	1,285	1,004	1,444	1,181	4,080	3,367	12	10	...	...	...	...	...	...	...	...	...
February.	10,949	8,900	3,232	2,813	2,004	1,538	1,427	1,197	2,529	2,028	62	44	...	...	...	...	...	...	...	...	...
March.	14,633	11,889	6,120	5,151	2,253	1,785	1,866	1,625	1,470	1,221	839	555	...	...	...	...	...	...	...	...	...
April.	8,432	6,482	2,884	2,238	1,045	820	780	658	632	493	1,460	1,069	...	...	...	...	...	...	...	...	...
May.	4,542	3,705	1,241	1,045	516	420	636	515	608	483	705	550	...	...	...	...	...	...	...	...	...
June.	2,740	2,034	222	201	224	168	746	596	830	549	39	32	...	...	...	...	...	...	...	...	...
July.	9,209	7,001	232	232	566	416	425	3,265	2,455	1,745	13	13	...	...	...	...	...	...	...	...	...
August.	19,325	14,942	347	290	1,114	792	10,909	8,393	3,951	3,061	92	72	...	...	...	...	...	...	...	...	...
September.	29,742	22,470	540	458	1,156	855	16,603	12,529	6,455	4,677	358	292	...	...	...	...	...	...	...	...	...
Total.	3,18,615	2,50,366	50,729	43,570	28,532	21,705	87,052	67,462	85,661	66,402	13,414	10,308	10,969	9,048	2,498	1,743	24,354	18,563	6,905	4,919	8,501	6,346

* The figures for these periods are taken from Nathani's "Plague in India," Vol. II, the correct figures not being known.
† The figures for these periods are taken from daily returns.
‡ Includes the populations of infected districts only.

POONA DISTRICT.

Area	5,352 sq. miles.
Population in 1891	1,067,800.
Density of population	199.51 per sq. mile.
Rainfall	27 inches.

Poona is bounded on the north by Ahmednagar ; on the east, by Ahmednagar and Sholápur ; on the south, by Málsiras in Sholápur, and Phaltan, Wái and Bhór in Sátára ; and on the west by Roha in Kolába, Bhór in Sátára, Pen in Kolába, and Karjat and Murbád in Thána.

Its height above the sea, its freedom from alluvial deposits, and the prevalence of westerly breezes, make the climate of Poona dry and invigorating and better suited to European constitutions than most Indian climates. The air is lighter, the cold more bracing, and the heat less oppressive than in most parts of Western or Southern India. There are three seasons : the cold season from November to February, the hot season from March to June, and the wet season from June to October. The coldest month of the year is January.

The soil of the District is lighter in the west than in the east. It belongs to three classes, black, red, and coarse gray. Poona is crossed by many rivers and streams, the chief of which is the Bhima, which for more than a hundred miles forms its eastern boundary. During the rainy season all of these rivers flow with a magnificent volume of water, and during the hot season shrink to a narrow thread in broad stretches of gravel.

There is no authentic record of plague in Poona previous to 1896.*

Between December 1896 and November 1899, Poona City and District have each suffered from four epidemics, the epidemics in each case being of crescent magnitude. The durations of these epidemics were approximately as follows :—

Epidemic.	Town.	District.	REMARKS.
1st Epidemic ...	January to June 1897 ...	February to March 1897...	{ Town : moderate. District : very mild.
2nd „ ...	July 1897 to June 1898 ..	July 1897 to March 1898	{ Town : severe. District : mild.
3rd „ ...	February 1899 to Oct. 1899...	July 1898 to March 1899	{ Town : every severe. District : mild.
4th „ ...	.....	July 1899 to Nov. 1899 ...	District : severe.

Poona City was originally infected from Bombay, and Poona District probably received the infection from Poona City.

First Epidemic (January 1897—June 1897).—Measures for the protection of Poona City were instituted as early as September 1896 : the first of such measures being Railway Medical Inspection, the arrangements for which were first made by the City and Suburban

Municipalities, but which were improved and extended by Government, who took it over from the 21st March 1897. By this means many arrivals suffering from plague were detected ; but legal power to send them to, or detain them in, hospital was wanting ; in the

* *Bombay Gazetteer*, Vol. XVIII.

absence of any segregation or surveillance system, it was impossible to prevent the importation of infection by persons incubating the disease, which, towards the end of January 1897, was declared epidemic in the City.

In March 1897 a Plague Committee was appointed to devise and introduce measures to deal with the epidemic, the President of which, Mr. W. C. Rand, I.C.S., was murdered in June 1897. In this, the earlier period of Plague history, the panic produced by pestilence, the stampede from any place where its incidence was assuming serious proportions, the distrust alike of hospitals and treatment, all combined to hamper and impede the success of the measures it was found necessary to introduce, as well for the sake of the stricken people themselves as for the protection of those as yet only menaced. Mr. Rand's description of the situation in those early days is impressive :—

“ The state of the City was one of panic. A large proportion of the leading men of the place had already left, or were preparing to leave, Poona on account of the outbreak. Several of the Municipal Commissioners and Honorary Magistrates were among the deserters. The majority of the Gujarāti and Marwadi traders (who have the grain trade entirely in their hands) were closing their shops and returning to their native countries. The mass of the people were, as a natural consequence of their ignorance, opposed to segregation either of the sick or of apparently healthy persons who had been exposed to infection. Most of the influential men left in the town declared themselves in favour of the principle of segregation, but their ideas on the subject were generally crude, and few, if any, of them were reconciled to the application of it to persons of their own position in life. Another fact to be reckoned with was that a section of the Brahmin community, including some of the most influential men in the City, were disinclined to support any measures that emanated from an official source, and were more likely than not to work against any operations that might be set on foot by Government to deal with the emergency.

“ Another important factor, too, in the situation was the state of the labour market. Many labourers were leaving the town on account of the epidemic, and owing to the panic that prevailed, those who remained could not be relied on to work regularly, especially if there was an element of danger in the work to be done. It was difficult, therefore, to carry on lime-washing and other measures of disinfection on a large scale with private labour. Under these circumstances, it would have been unsafe to attempt to carry out any extensive operations against the plague without a disciplined and reliable agency. It was of the utmost importance to crush the epidemic with the least possible delay, both to stay the great mortality that was taking place in Poona and to prevent the spread of the disease to the other towns of the Deccan, in none of which had it so far attained epidemic proportions.”

Nevertheless, the first epidemic was of short duration, for the disease rapidly subsided during April and May 1897, the following being the total recorded figures :—

First Epidemic.	Cases.	Deaths.
20th January to 27th May 1887 ...	2,854	1,834

But this, as Mr. Rand points out, was probably only about half the true plague mortality.

In the District, during this first year, the spread of the disease was very limited and its virulence slight, as the following figures, which do not include the City epidemic, and which cover the entire first period, show :—

Poona District.

First Epidemic.	Cases.	Deaths.
January to May 1897	215	189

Second Epidemic (July 1897—March 1898).—Throughout June 1897 there was an almost complete subsidence of the disease, both in the City and District; and it was hoped that the disease would die out altogether. These hopes were not realized: for the City was not free from plague for any one week during the following ten months, and it soon passed through a second epidemic of far longer duration and greater severity than the first.

No details can be given for this second epidemic, as no report has been received for the period June 1897 to June 1898 for Poona City: but the following statement shows how, from the middle of September 1897, the figures rose steadily and rapidly, subsiding again towards the end of December:—

Week ending				Cases.	Deaths.
3rd September 1897	...	...		13	12
10th "	"	...	...	22	15
17th "	"	...	...	66	41
24th "	"	...	...	100	74
1st October	"	...	...	166	110
8th "	"	...	...	199	143
15th "	"	...	...	321	191
22nd "	"	...	...	349	281
29th "	"	...	...	510	365
5th November	"	...	...	650	460
12th "	"	...	...	524	393
19th "	"	...	...	611	436
26th "	"	...	...	525	433
3rd December	"	...	...	496	394
10th "	"	...	...	520	383
17th "	"	...	...	408	350
24th "	"	...	...	285	250
31st "	"	...	...	190	167
Add—August 1897				71	40
Total for the second epidemic up to the end of 1897				6,026	4,538

After Mr. Rand's decease in June 1897, Mr. R. A. Lamb, I.C.S., was appointed Chairman, Poona City Plague Committee, which post he held until February 1898: and he was succeeded by Colonel (now Brigadier-General O.'M. Creagh, V.C., who remained Chairman until the dissolution of the Committee by Government Resolution No. ²⁵⁵⁶/_{2982-P} of the 7th May 1898, when Major Reade, R. A. M. C., was placed in charge of all Plague operations in the City with the title of Chief Plague Authority. This last arrangement has remained in force up to the present time.

In Poona Cantonment a Plague Committee was appointed in November 1897 by order of Government, the first Chairman being the late Lieut.-General J. Duncan, Commanding the Poona District, and on his death Major-General G. Hogg, C.B., was appointed.

Major-General C. J. Burnett, C.B., took over the duties of Chairman, Poona Cantonment Plague Committee, on 31st December 1898.

Lieut.-Colonel T. R. Macpherson, I.S.C., was appointed Chief Plague Authority, Poona Cantonment and Suburban Municipality, on 23rd February 1899, *vice* Lieut.-Colonel Newnham-Smith, proceeding on leave to England.

Forty-one cases remained in the hospital on the 1st June 1897. No new cases being admitted on the 31st June 1897, there were only five remaining. From the beginning of July, however, admissions increased and continued to increase till they became very numerous,

the maximum of 493 patients in hospital being reached on the 15th November 1897: and the largest number of admissions, 68, was made on the 17th November 1897. -

From this date the number slowly subsided, until on 31st March 1898 only 33 patients remained. Beginning with the 2nd Bombay Lancers (July 1897) cases came in from Kirkee (August 1897), Ghorpuri (August—September 1897), Bhosári and Poona City (September 1897): and towards the end of the same month from Poona Cantonment, Sadar Bazár, Sholápur Bazár, 19th Bombay Infantry and 2nd Bombay Grenadiers also. The worst months were November and December. Corrugated iron was used for roofs during the monsoon only, and throughout the wards were quite dry and rain-proof. In this connection it may be mentioned that Mr. Lyon personally superintended the erection of all the wards, and succeeded in building them when it was difficult to get the necessary labour. There were in all 36 wards, with accommodation for some 440 people: and 47 tents which could receive some 188 more. The latter were practically reserved for males: females being put into the wards. There was never any overcrowding: and sufficient ventilation at night was secured by the few feet of space between the walls and roofs.

Rows of huts were built for the staff and establishment, which at one time numbered 320. Of these 104 were ward-boys and ayahs and 59 were Police and watchmen.

The latrine, water-supply, and bathing arrangements were good: and the drainage, which at first was unsatisfactory, was afterwards improved. Fire drill was practised: and a bell at noon daily was a signal for a general disinfection of the floors with perchloride of mercury 1 in 1,000. A soap-and-water bath, followed by one of perchloride of mercury, invariably preceded the discharge of the cured. Clothes were always disinfected by boiling. As regards suspects, no record of daily numbers was kept: but the total number was 1,593, of whom 650 were ultimately admitted to hospital for plague. The hospital was generously supported by the Poona public, not only money, but flannel, clothes, etc., being given. The latter were distributed to the poor on discharge: the former being spent on fruit and luxuries for the sick.

Sex.	ADMISSIONS.			Deaths.	Recoveries.	Percentage of deaths to recoveries.	Remaining on 31st March 1898.
	Remaining.	From 1st June 1897 to 31st March 1898.	Total.				
1	2	3	4	5	6	7	8
Males	20	1,723	1,743	1,244	480	68.2*	19
Females	13	1,706	1,719	1,152	556	63.9*	11
Children (ten and under).	8	709	717	440	274	53.9*	3
Total ...	41	4,138	4,179	2,836	1,310	64.1*	33

* In calculating these percentages, 489 moribund cases have been deducted both from admissions and deaths and 33 remaining ones from admissions only.

From the beginning of December a system of visiting was instituted. Friends and relatives could visit patients on Wednesdays and Sundays between 4 and 6 P.M., each patient being allowed two visitors at a time. Although not allowed inside the wards, these people could see and converse with their sick over the walls of the wards, which were only some three or four feet high. Contact and discontent were thus prevented. This privilege was evidently appreciated; as, beginning with 240 visitors on 8th December, the number was 620 on the 15th. From 8th December 1897 to 31st March 1898 the total number of such visitors was 10,246.

In the district during this second period plague was never very severe; the highest figures registered being 269 cases—179 deaths (week ending 3rd September 1897) and 240 cases—180 deaths (week ending 5th November 1897).

Poona District.

The only reports received for Poona District for this period were for the towns of Ghodnadi (suburb of Sirur) and Manchur (Táluka Khed), and for the village of Mawdi Karipather (Purandhar Táluka).

Plague began in this Táluka in March 1897, in which month 2 cases were discovered in the town of Ghodnadi (population, 7,656). The infection was due to Poona. Six members of the same family had previously died, their deaths being ascribed by the Hospital Assistant to the following causes:—Chronic phthisis, pneumonia, dysentery and grief; but “there is little doubt,” says the then Collector, Mr. Lamb, “that these were all plague cases.” No further cases were reported till the 27th July 1897, when Surgeon-Captain Kilkelly, being called in to examine some sick persons, found them to be suffering from plague.

Sirur Táluka.

The fact that the mortality was generally above the average during the interval between March and July 1897 appears to point to the presence of undetected plague throughout. The following remarks by Surgeon-Captain Kilkelly, on its origin and dissemination, are interesting:—

“It is almost certain that infection in the first instance was from prostitutes in the town. Rats may have carried the disease. Cats were frequently found dead in plague houses in the town of Sirur, and a few days after plague occurred among my servants, a cat was brought to me, obviously out of sorts, and with enlarged and tender sub-maxillary glands. I kept the animal under observation, and in about ten days it recovered completely.

“It is difficult to obtain accurate dates, but among my private servants on one occasion, at least, the incubation period was exactly eight days. One of two stable boys sleeping together was attacked. I went into tent that day and took all servants with me and had them all strictly under observation. On the eighth day exactly the second boy became ill of plague. On the other occasion it seemed that incubation period was much shorter. In the open, infection was almost nil, but in cases of people living in crowded houses whole families were attacked. More than once it was noticed that when cases occurred in a new locality, several fresh cases appeared in the houses around after about 15 or 20 days. If the incubation period is 8 days, this might be explained by supposing that rats or cats, becoming infected by the first case, developed the disease in a week, and infected healthy persons, who, in their turn, did not show signs of the disease for some days. Dead rats and cats were found in numbers. No case was traced to grain.”

The following measures were taken to suppress the outbreak:—

“Two Hospital Assistants and a disinfecting party of 6 men and 6 sweepers were sent from Poona to Sirur. The town was divided into four divisions, and search parties told off to each division. These parties began their work by taking a complete list of all houses and persons resident in their divisions. Absentees were thus easily detected. The sick men who came from Poona were each made mukádams of a disinfecting party, and the work of disinfection was carried on under the personal supervision of Surgeon-Captain Kilkelly,

aided by Mr. Joshi, Acting Mámlatdár, and the Hospital Assistant in charge of the town, Pratap Gangaram. Four volunteers were found who carried on the work in a most thorough manner, and when they had taken over the duties, few cases escaped detection. A party of sweepers was formed, and systematically disinfected and cleansed out every courtyard and privy in the town. Several cases occurred in "D" Division, Kámátipura, towards the end of October. This part was accordingly completely evacuated for 15 days, and the houses thoroughly ventilated and limewashed. The inhabitants were put into huts under observation. Only two fresh cases occurred among them while in the fields. The improvement continued during November. Plague showed no tendency to rise again. Houses in which cases had occurred before the 20th October—20—were put to rights by their owners, and allowed to be inhabited after they had been passed by the Medical Officer, but the roofs were not closed.

"In December an observation camp was formed, in which persons entering Sirur were detained ten days under observation. Five imported cases of plague were detected and sent to hospital. On the 4th December, a case occurred near the police lines in some old thatched huts; these huts were unroofed and the thatching burnt."

The last indigenous case occurred on the 22nd of December 1897; the total number of cases treated in hospital was 442, of which 297 died and 147 recovered.

Inoculation was tried on a very small scale at Ghodnadi; the following is Mr. Lamb's description of the experiment:—

"Inoculation was only tried on a very small scale. On August 28th, 14 persons were inoculated with a small dose of Dr. Haffkine's lymph; one of them afterwards died of plague on September 23rd. On September 30th Surgeon-Captain Kilkelly inoculated himself and 34 others with a stronger dose. But as one man, who no doubt was previously infected with plague, died on the following night and a second man was very seriously ill, apart from the temporary fever which the inoculation produced on them all to a greater or less extent, no one was subsequently found willing to volunteer for inoculation. None of the others inoculated at this time were afterwards attacked with plague."

The outbreak at Ghodnadi did not cause any great dissemination of the disease. Before plague was declared epidemic in the town, but while there was yet a fear of an outbreak there, a very large proportion of its inhabitants fled: precautions being taken afterwards to prevent persons from leaving the town without passes.

The total number of cases and deaths recorded in the village of Sirur, outside Municipal limits and in the neighbouring villages, in Sirur Táluka, were 121 cases—104 deaths; of which 109 cases—95 deaths occurred in the open fields within the boundaries of the town of Sirur. Besides this, some villages in the Ahmednagar District, the border of which is only one mile distant from Ghodnadi, were infected by that town.

Infection was introduced into the village of Manchar by a Marwadi woman belonging to the village of Avsari Budruk. A death from plague had already taken place at her house at the latter place when she came to Manchar and infected a woman of the family with whom she put up; both these women shortly after died of plague. The disease now spread from house to house, carrying off two or three members from each infected family: the Marwadi and Koshti castes being more particularly attacked. Complete evacuation of the village was promptly enforced; all houses were kept entirely open; infected houses insufficiently lighted or ventilated had holes made in them admitting of light and fresh air in abundance. Disinfection was carried out in every house, whether infected or not: and the following remarks by Mr. Lamb on the effect of these measures are interesting:—

"All these measures being adopted, the village became perfectly free from plague poison; in proof of this not a single plague case occurred after the re-occupation of the village, which was unoccupied for $3\frac{1}{2}$ months continually. Out of the several anti-plague measures resorted to, the evacuation of houses at once was found to be most effective; from

the commencement of the plague on the 20th November 1897 to 19th December 1897, 15 cases had occurred; the village was evacuated on the 19th December 1897; after that date there were only 7 cases, the plague then stopped, and there was complete subsidence of it for one month from 5th January 1898 to 6th February 1898, except for a sudden outbreak in one of the Koshti families which lost 10 of its members; the disease was suppressed on 6th January 1898, *i.e.*, within a fortnight only after the evacuation of the village. The disease was not communicated to any other village in the vicinity of Manchar."

The figures for this epidemic were 34 cases—31 deaths.

The village of Mawdi Karipatker (population, 622) was infected by a Mahomedan who arrived from Poona and was attacked on the 19th of October 1897. In the following week there were 21 cases—7 deaths. Mr. Lamb, the Collector, visited the village and ordered its complete evacuation, which was carried out by the 10th of November, a few of the infected houses being burnt down. The rest of the houses were disinfected and whitewashed, the floors were dug up, and they were left open to sun and air for 10 days.

Mr. Lamb makes the following remarks on the cost of the measures taken :—

"The cost of the measures taken by Government was approximately Rs. 150 : the only expense incurred was the employment of a gang for whitewashing and disinfecting the houses and the payment of the Mhárs who acted as watchmen."

Fifty-six households, numbering 306 people, were affected in this village. Out of these 153 were attacked and 99 died. The first case occurred on October the 19th, and the last on December the 29th, 1897. The following statement shows the numbers of cases and deaths which occurred before and after evacuation respectively :—

From	To	Cases.	Deaths.	REMARKS.
19th October 1897 ...	10th November 1897 ...	119	81	{ In the 3 weeks prior to evacuation.
11th November 1897 ...	29th December 1897 ...	34	18	{ In the 7 weeks subsequent to evacuation.

The course of plague in these three small places has been treated in considerable detail, owing to the want of information for the rest of the Poona District during this period; they are presumably typical of, and similar to, the measures enforced and the results attained elsewhere.

Plague re-appeared in Poona Cantonments on the 27th June 1897, with 2 cases

Kirkee, Poona Cantonment, amongst the followers of the 2nd Bombay Lancers. On the 2nd July one sowár, on the 4th three sowárs, on the 5th one child, on the 6th two sowárs and two children, all belonging to this Corps, were attacked. The lines were vacated on the 6th July 1897, and the Regiment encamped on ground adjoining. The origin of the outbreak was probably importation from Bombay. As the sickness still continued, each squadron on the occurrence of a case was moved into camp at Harapsar, D Squadron alone remaining in the original camp. Dropping cases still persisting, on the 15th September the whole Regiment, with the exception of a small party left under canvas to take care of the lines, moved across the river Mula Mutha into camp. After this no more cases occurred. Meanwhile, some chawls on the edge of the lines in which plague cases had occurred were demolished, and the lines themselves thoroughly disinfected and lime-washed, the whole site being brought into a sanitary condition.

On the 12th July, the Kirkee Bazár (population, 6,000) reported 4 plague cases, and, in spite of all the precautions taken, dropping cases continued till 31st July, on which date 12 cases occurred and the disease became epidemic.

On the 7th August the disease appeared in the Royal Artillery followers' lines contiguous to the Kirkee Bazár, and from the 12th August these followers were moved block by block into a health camp, where they remained for a week, each block being thoroughly disinfected while it was vacant. No case of plague occurred in any of these blocks after their re-occupation.

Up to the 20th August, all measures to combat plague had been carried out by the Cantonment Magistrate, assisted by the Senior Medical Officer, under the Officer Commanding; but Major-General J. Duncan, in view of the increasing spread of the disease, appointed Major (now Lieut.-Colonel) Temple, R. A., Special Plague Officer; and he assumed charge on that date.

From the 25th August, two search parties divided between them the duty of daily visiting every house in the bazár: and a permanent disinfecting party systematically disinfected, block by block, every building. Practically the same course was adopted in the lines of the followers of the 28th Pioneers, of the Gunpowder Factory, and of the Sappers and Miners.

The epidemic quickly succumbed to these measures, and from the 18th September 1897 the plague staff was reduced, and only occasional cases occurred.

On the 9th August, Poona Cantonment reported an imported case from Kirkee: and from this date to the 16th September there were 6 indigenous cases and 2 imported from Kirkee: but from this last date the figures rapidly rose till the disease assumed epidemic proportions.

On the 28th September, the troops in Poona Cantonment were attacked, 2 cases occurring in the 19th Bombay Infantry, and the following day the same Corps reported a fresh case, and the 2nd Bombay Grenadiers 6 cases. Both the Regiments were at once moved into camp on the Poona Race Course; but the sickness still continuing, on the 15th October the camp of the 19th Bombay Infantry was moved to the top, and on the 23rd that of the 2nd Bombay Grenadiers to the bottom, of Gibbet Hill; and 3 cases occurring in their lines, the 14th Bombay Infantry joined these two in camp on Gibbet Hill on the 27th October 1897.

Cases still continuing to occur, it appeared probable that they were due to families visiting the bazár: and the precaution was, therefore, taken to move the families away from the men, and further from the bazár; guards preventing their exit from camp. No case occurred in any of these three Regiments after this last precaution.

On the 5th October 1897, plague broke out amongst the followers in the Transport lines (about 400 strong with their families), and from this date 24 cases occurred up to the 4th November, when they were moved into camp near the Rifle Range. Fourteen more cases, however, occurred, and on the 13th the position of the camp was slightly changed: all the followers, with their tents and belongings, being carefully disinfected. From this date no case occurred amongst them.

Meanwhile the epidemic in Cantonments showing a tendency to increase, Major-General Duncan placed Major Ross, Durham Light Infantry, in sole charge of the plague operations.

On the 17th November 1897 a Plague Committee was established by order of Government (*vide ante*). It consisted of—

Chairman, Major-General J. Duncan.

Members. { Lieut.-Colonel W. J. Fawcett, R.A.M.C.
 { Major W. C. Ross.

This Committee held its first meeting on the 19th November 1897, and decided on the following measures, which since the 15th idem had been put into effect :—

(i.) Partition of Cantonments into three divisions, each under a British Officer ; and of these again into 17 sub-divisions in all, each under a supervisor who was either a native gentleman or retired Native Officer. Each supervisor maintained a list of all the inhabitants in his sub-division.

(ii.) Search party for each sub-division.

(iii.) Divisional establishment (common to all sub-divisions in its division) for treatment, ambulance, segregation, disinfection, and sanitation.

(iv.) Two lady-searchers each for Divisions I and II, for visiting purdah ladies.

(v.) Commissioned Medical Officer's certificate for every death.

The result was a practically complete search of the whole of Cantonments daily, with prompt segregation, attendance, and disinfection.

A Health Camp (ultimately capable of accommodating 1,000 people) was started on the 16th November in the Lál Bágh, to which water was laid on and oil lamps supplied, and for which latrines and bathing places were erected. Into this camp, as room became available, the inhabitants of the most infected parts of the bazár were moved in blocks ; and here they remained for ten days—a Banníáh supplying food, and a European officer ordering subsistence money for the destitute. On arrival in camp every article was thoroughly disinfected. The inhabitants during the day attended to their ordinary business, returning at night to sleep in camp. The value of such a camp is proved by the fact that only 1 case occurred after the people returned to the bazár : and that one a woman who had been but six days in camp, and was attacked the evening of the day she left it. A second Health Camp (capacity, 400) was established early in December, about two or three hundred yards from the Wánowrie Bazár, where the disease was severe. It was worked on the same principles. In this case the result was still more satisfactory, for neither in the camp nor after their return to their houses was there any indigenous case of plague. In this connection it may be stated that a small row of huts was omitted when the rest of the Wánowrie Bazár people were turned out ; within 24 hours 5 cases, including 3 deaths, occurred amongst those left behind—an incident which proved a valuable lesson to the people.

In January 1898, Wánowrie village was the only plague-spot in Cantonment limits, but it was not until the 23rd January that the Health Camp could accommodate its inhabitants. As each block was vacated by the inhabitants, the houses were immediately thoroughly cleaned, disinfected, and lime-washed. Houses unfit for habitation were demolished.

The numbers put through the two camps were :—

Camp.			From Sadar Bazár.	From Cantonments.	From other places.	Total.
Lál Bágh	...	...	2,310	343	874	3,527
			From Wánowrie Bazár.	From Cantonments.	From Wánowrie village, &c.	
Wánowrie	...	...	662	69	1,935	2,666
Total for both Camps						6,193

From June 1897 to February 1898, 3 Europeans were attacked—a Sergeant's wife living in Wánówrie Barracks (4th November 1897) and 2 soldiers (20th and 29th January)—all of whom recovered.

The last native case was on the 28th, and the last European on the 29th of January 1898. The total number of cases was 422 and deaths 298.

During March 1899, 5 imported cases (2 fatal) occurred, and in April indigenous plague appeared. During May it steadily increased and ultimately developed into a severe epidemic, which, however, falls outside the scope of the present review. Throughout the long period of immunity precautionary measures had not been relaxed. All arrivals by rail from infected areas were disinfected; all arrivals, whether by rail or road, whether from infected areas or not, were placed under 10 days' surveillance. Special precautions were taken to prevent infection by road:—

“To prevent the introduction of plague, by road, the Cantonment was divided into wards, each under a supervisor. Each supervisor has a census of the inhabitants of every house in his sub-division, and it is his duty in his daily rounds to note the arrival of strangers from outside and to order them to attend for surveillance at one of the hospitals.”

Also to prevent infection being introduced from the City—

“To guard against introduction of plague from the City, persons were prohibited from changing their residence from one house to another without a pass from the Chief Plague Authority, and no empty houses could be occupied without such a pass. Such measures can only be partially successful, as with plague in the City it is purely a question of time its spreading to the Cantonment. The two are now practically one town: along the Bháwani Peth road there is really no break in the houses. Hundreds of people work in the Cantonment in the day and return to their houses in the City in the evening. Many Cantonment residents have relations in the City and *vice versa*, and it is practically impossible to prevent them from exchanging visits and spending a night or so in each other's houses. In this way infection is continually being introduced; it may for a time with disinfection be kept back, but eventually some area must become infected.”

The measures taken to ensure early detection of the disease were—

1. Certificates of death signed by a Commissioned Medical Officer before burial.
2. Daily list of sick made out by Ward Supervisors: the sick being visited by a Plague Medical Officer.

As regards the measures introduced, the Chairman, Poona Cantonment Plague Committee, reports—

“*Disinfection and ventilation.*—In the Cantonment the only method followed was to saturate the floors with an acidulated solution of perchloride of mercury, strength 1 to 1,000; the same solution was squirted over the walls and ceilings of all infected buildings, and all articles of clothing, not burnt, which might reasonably be supposed to be infected, were dipped into buckets of the solution. The tiles were removed, where, by so doing, sunlight could reach the infected rooms, and the houses were vacated for a period of 10 days, the doors and windows being left open. After the disinfected houses had dried from the perchloride solution, they were whitewashed.

“*Evacuation.*—This was not tried during the year under report.

“*Inoculation.*—On the 12th April last arrangements were made to carry on inoculation against plague. The necessary serum was obtained from Professor Haffkine's Laboratory, Bombay, and two private practitioners, Dr. Mody and Dr. Erasmus Dias, very kindly consented to carry on the work free of charge. A notice was issued to the public in English and Maráthi, inviting them to be inoculated, but at that time there were only a few sporadic cases of plague in the Cantonment, and the fear of infection was not sufficient to induce people to undergo the operation. Shortly afterwards, Dr. Erasmus Dias (on his own

responsibility and without informing the Plague Committee) circulated a leaflet in Marathi quoting from a report of Dr. Leumann's on inoculation in Dhárwár and Hubli, and drawing attention to the very great protection which it afforded against plague. This, combined with the previous notice, caused quite a panic amongst the banias in the bazár, who were convinced that inoculation was to be made compulsory, and many at once made arrangements to leave Poona and return to their homes. This was brought to my notice, and I therefore proceeded to the bazárs, collected the banias round me and assured them that under no circumstances would any person be forced to submit to be inoculated. This re-assured them, and I heard nothing more of any uneasy feeling in this respect.

"Up to the 1st of June only seven persons were inoculated, but since then plague has increased and people have come forward more readily, over 50 having been inoculated already in this month (June). It is now proposed to start inoculation at the Charitable Dispensary and endeavour to induce the poorer classes to protect themselves in this manner.

"Subsequently much of the antipathy to inoculation of the part of the Cantonment people vanished, as over 20,000 voluntary inoculations were carried out within four months.

"*Segregation.*—The system in force in the Cantonment, is, to send all contacts (persons from infected houses) to a Segregation Camp for 10 days; on arrival at the Camp their clothing, &c., is disinfected and they are detained there for 48 hours; at the end of this time they are permitted to go about their business in the daytime, but return to the Camp to sleep until the 10 days are completed. When the accommodation in the Segregation Camp permits, the people on either side of infected houses are also segregated. This was invariably done at the commencement of the epidemic, but the Camp is now too crowded to allow of this. More huts are now being built and the segregation of the persons from neighbouring houses will again be resorted to as soon as there is accommodation in the Camp for them.

"*Re-occupation.*—Disinfected houses were allowed to be re-occupied after they had been kept vacant for a period of 10 days.

"In three instances plague appeared in houses which had previously been disinfected. For instance, on the 6th of May, No. 142 Main Street was disinfected as a precautionary measure, there having been a case of plague in the next house. On the 5th of June, almost exactly a month after, the man living in No. 142 Main Street was attacked with plague and died.

"The same thing happened at No. 712 Kotwal Mohella, which was disinfected as a precautionary measure on the 8th May, and where a girl was attacked and died of plague on the 6th June. At No. 658 Sachapur Street, a badly infected locality, and inhabited by some 11 families, the whole place, after most careful disinfection on the 16th May, was kept vacant for some 12 or 14 days, after which one or two families moved back into their rooms, the other houses still remaining vacant. On the 11th of June a fresh case of plague occurred in one of the houses, the boy dying."

The attitude of the people during this period appears to have been eminently satisfactory.

"*Attitude of the people.*—The people have been most patient, and submit in the most ready and admirable manner to the restrictions which it is found necessary to impose on them. These are made as slightly harassing as possible, but still they are a great infliction, and the way the people submit to them without complaint is most praiseworthy."

Third Epidemic (July 1898—November 1899).—Throughout April, May and June 1898

Poona District.

there was almost total subsidence of plague in the Poona District and City, although no week passed without dropping cases occurring in both. From the middle of July the district figures steadily rose and culminated in a moderate epidemic which lasted throughout September, October and November 1898. The highest weekly figures were 180 cases—115 deaths (week ending 14th October 1898) and 177 cases—131 deaths (week ending 28th October 1898).

On the measures taken to prevent this third outbreak and to control it when it occurred, Mr. W. D. Shephard, I. C. S., the Collector, reports as follows:—

"(1) To prevent the introduction of plague, the village officers were ordered to watch carefully all arrivals from infected areas and to keep them outside their village for a period

of ten days. The measure worked on the whole very successfully, the co-operation of the villagers being generally obtained, a consequence in some cases of previous experience of plague and a recognition of its highly infectious nature.

A further precaution was the establishment of disinfecting camps at certain stations on the main line between Poona and Bombay, where all arrivals were disinfected before being allowed to pass into the *tálukas*. This measure was also useful and highly successful.

(2) To assist the discovery of plague cases all village officers were directed to report any abnormal mortality to the *Mámlatdár* of their *táluka*, and they were supplied with copies of the circular describing the symptoms of plague. Registers were kept of all arrivals and departures of persons not belonging to the village. These measures were also successful.

(3) The most ordinary source of infection is the arrival from an infected area of persons carrying infection either in their clothes or bodies. At Khed a Mahomedan family arrived from Bombay in August. Their clothing was disinfected; they were detained outside the town for ten days; on the 12th day, a boy of 14, one of the family, showed symptoms of plague. From this case plague spread gradually throughout the town.

At Alandi, a Gurav family who, while visiting Chinchwád, had put up in an infected house, returned to Alandi and infected that town also.

At Bhongaoli, in the Purandhar *Táluka*, plague was introduced by a woman who had been to an infected village in the Wái *Táluka* of the Sátára District. At the same time a washerman returned from an infected village in the Bhor State. Then rats began to die in Bhongaoli, and the village rapidly became infected.

(4) When plague deaths occurred, the clothing and bedding of the deceased was ordinarily burnt, but sometimes only washed. The contacts were segregated and their clothing and bedding washed and sometimes disinfected. Disinfection was the regular course where a Hospital Assistant was available. On some occasions the clothing was washed or disinfected a second time when the infected house was re-occupied.

All evacuated houses were sooner or later disinfected with Perchloride of Mercury, all rubbish being previously swept out and burned. Care was taken to thoroughly saturate with the solution the floors, walls and ceilings. Occasionally roofs were opened to admit air and light, and in some cases holes were made in the walls for the same purpose.

Grass huts in which plague cases occurred were invariably burnt.

(5) Alandi, Kharpudi Budruk and Kherdi, Pimpri, Rase Brahmanwadi and Bhongaoli were completely evacuated within a very few days of the first indigenous cases of plague. Partial evacuation was resorted to at Khed and Chakan. Evacuation certainly lessened the violence of the epidemic but did not completely stop it. Cases continued to occur in the huts into which the people had gone, and the inability of the family to refrain from attending *en masse* on their sick relatives, unless strictly prevented, ensured that a large number should die where many might have lived. This can only be obviated by having separate quarters for each, allowing only one attendant who should ordinarily sleep outside the patient's hut, and not allowing him or the patient to rejoin the family until the latter is cured and they have both been disinfected. A system of village hospitals might ensure this being done, but such hospitals are invariably unpopular, and if villagers are to be forced to do everything that is required, a very large body of men would be necessary, entailing a correspondingly heavy expenditure. Even, however, assuming that evacuation is not carried out in an ideal manner, it is still very effective and greatly lessens the mortality of the epidemic.

(6) Inoculation was only carried out on a small scale, 50 persons being inoculated at Chinchwád and 477 at Aundh. At Chinchwád, one inoculated woman died of plague.

(7) Strict segregation was only insisted on when cases first occurred in a village. Afterwards it became merged in the evacuation measures referred to above. The segregated family was treated like a suspicious arrival and simply kept outside the village for a period of ten days.

(8) Temporary huts were erected for plague patients at Chinchwád, Chakan, Khed, Arvi, Bhongaoli and Alandi. They were supposed to be occupied only by the patient and one attendant, but this rule was honoured more in the breach than in the observance.

At Alandi a regular hospital was opened in some dharamshálas adjoining the town. Hospital Assistants, Ward-boys, Ayahs, and the usual hospital staff were provided. The treatment

was either Europe or Native, according to the wishes of the patient. Food was supplied to the poorer patients, and coats, blankets and pillows were also found them. A small force of Police was specially engaged to see that orders were carried out. This was done effectively at Alandi and with less success elsewhere.

(9) No one was allowed to re-occupy his house until it had been disinfected and until the officer in charge of plague operations was thoroughly satisfied that the infection had disappeared. In consequence of the ease with which this was done, no cases of re-infection occurred after the houses were again occupied.

(10) The people acquiesced in all the measures adopted for their welfare, except (1) inoculation, and (2) separation from their sick relatives. Generally speaking, they will have nothing to do with inoculation, and great tact has to be exercised to prevent them from becoming infected from contact with the sick. They are generally very keen to keep plague out of their villages.

(11) The plague work in the District was under the general control of Major Reade, R.A. M. C., who had from time to time a Staff Corps Officer under his orders, notably Lieutenant Wright, Irish Rifles, and Major Kreyer, I. S. C. At Alandi the measures were supervised by Captain Morgan, R. A. M. C., assisted by Ráo Sáheb N. N. Satho, the Plague Mámlatdár, and Mr. G. B. Brahme, B.A. All these officers worked extremely well and were assisted by the Schoolmasters of all the villages attacked and by numerous Hospital Assistants, of whom the most efficient workers were Mr. G. B. Sathe, Hospital Assistant, Khedane, and Mr. L. B. Yadav, Hospital Assistant, Alandi."

From May 1898 to February 1899, Poona City was free from indigenous plague. The Poona City (excluding cantonment and suburbs). large number of imported cases which occurred, however, were naturally a constant source of anxiety. These imported cases during this period numbered 37, of which 13 were detected at the Railway Station and sent to the General Plague Hospital; seven others also came by rail, but were only detected after taking up their residence in the town; the remaining 17 were imported from neighbouring villages. It is interesting to note the various methods by which these last 24 cases were discovered, five were discovered by means of death-certificates; two were found ill on the road and taken to hospital; two occurred in the Savar's Gate Observation Camp; the discovery of the remaining 15 was due to the surveillance system.

As each imported case was discovered every effort was put forth to prevent its establishing infection; and these efforts were so far successful that up to the middle of February 1899 no spread of the disease occurred.

As regards the organisation and means taken up to the above date, Major W. L. Reade, R. A. M. C., Chief Plague Authority, Poona City, reports as follows:—

"Mentioned in their place, the organization may be said to consist of two lines of defence, the first line includes surveillance of arrivals, and the second line, corpse-inspection. Under the term surveillance is included (a) inspection of arrivals by rail, (b) inspection of arrivals by road, (c) surveillance of 'contacts.'

(2) The town is divided into 17 districts, and each division is placed in charge of a Chief Volunteer, usually a native gentleman of position in the division. The Chief Volunteer is the executive plague official of his district, and he has working under him a certain number of other voluntary workers and two paid clerks.

(3) Each division is provided with an office, and the spirit of the voluntary system has so far developed in Poona that these offices are placed rent-free at the disposal of the Plague Authorities.

(4) The surveillance of arrivals by rail and road is carried out at the divisional office, and in the event of the non-attendance of a person on the surveillance list, a clerk or peon is at once sent to visit the house and to find out the cause of non-attendance. Arrivals by rail are sorted at the Railway Station, some are vouched for by Volunteers, and on being furnished with a surveillance ticket are allowed to go into the town, also those in possession of ward or traders' passes. The ward pass certifies that the owner is an inhabitant of a certain house in the town, and the ticket is signed by the Chief Volunteer of the division in which the person lives.

(5) Traders' passes are issued to recognized traders of the town whose business entails a good deal of travelling. The remaining arrivals by rail, *i. e.*, those who are neither vouched for, nor are in possession of a ward or a traders' pass, are escorted to the Railway Observation Camp, where their names and addresses are taken. On depositing their luggage or other valuables these persons are furnished with a ticket and allowed to go in the town; this ticket has to be signed by the householder of the house in which the new arrival intends to live, and it has also to be certified by the Chief Volunteer of the division. On presenting the ticket at the Camp the holder of it is released. The surveillance of arrivals by road is more difficult to carry out, as for this class there exists no central place of arrival; we are therefore dependent on the house-to-house visits, which the Volunteers and census clerks pay once a week to each house in the division.

(6) Notice has been given to all the householders in the town that all cases of illness, all deaths, also arrivals at or departures from their houses must be reported to the Chief Volunteer of their division, also the presence of dead rats in or near their premises.

(7) If every householder carried out these regulations, an organization for house-to-house visitation would be needless, but unfortunately many householders are not sufficiently impressed with the necessity for carrying out these duties. The degree in which these obligations are met varies considerably, but it may be roughly asserted that the better educated carry out the rules to a larger extent than the poorer classes. A person under surveillance has to attend at the divisional office every alternate day for ten days.

(8) Surveillance of arrivals has now been done away with, or the part of it which entailed attendance at the divisional office for ten days. Shortly after the present outbreak, which commenced in the middle of February 1899, it was found that it became impracticable as personation became constant. Several instances occurred of persons under surveillance sending some one else to personate them, as a rule the person who should have come being ill in a house. It was therefore decided to do away with compulsory reporting of the arrival and to throw the onus of report of illness on the householder. This system has now been working for two months, and I do not think the efficiency of the organization has suffered through its abolition.

(9) The necessity for an accurate house census is of importance, as by means of this system it ought to be possible to limit the spread of the disease. On a case occurring in a house the number of 'contacts' would be accurately known and the tendency to spread the disease would be lessened. It was owing to the inaccurate and slipshod way that the house census was kept in three of the divisions of the town that prevented the present outbreak from being limited to a greater extent than has been the case. This weakness unfortunately only became apparent after the disease had taken root in these divisions. It may be said that the fact of a person's name being entered in the house list will not act as a sufficient deterrent to leaving the house and going elsewhere, but the knowledge that a 'contact' is still at large is an incentive for search. An additional safeguard is the responsibility which the Local Authorities cast on the householder to produce the number entered on the house list. If the correct number of persons is not produced, the household can be placed in close segregation; this will generally have the effect of the correct number being produced. Under the present rules no legal responsibility can be cast on the householder to produce the number of persons living in the house; he is only responsible for reporting the arrivals of a person from an infected area. It would considerably facilitate the work of keeping an accurate house census if the responsibility was legalised, and the householder made responsible for a report of all arrivals in his house, irrespective of the locality from which they came; he should also report all departures from the house.

(10) *Surveillance of 'contacts.'*—When only isolated cases of plague had to be dealt with, and a small number of plague 'contacts' to be arranged for, it was found most convenient to keep the latter under surveillance in a building in the town. The house in which the case occurred was disinfected, also the clothing of the inhabitants, and these people had to present themselves daily for medical examination."

But in spite of these careful and vigorous precautions, plague would not be denied: towards the end of February 1899, it became indigenous, and, after considerable fluctuations of virulence throughout March, April and May, it burst out into an epidemic of exceptional severity, lasting throughout June, July, August and September—causing a panic which led to the flight of over half the City and destroying nearly 10,000 people—the history of which, however, lies beyond the scope of the present review.

Plague measures in Poona City are differentiated from those in the other large towns of the Presidency by a striking characteristic ; the rigid enforcement of the production of a certificate of the cause of death before disposal of a dead body. Doubtless this measure conduces to the detection of plague, but the sustained violence of the recent epidemic seems to show that it is of little use in combating an outbreak.

It has been stated that the third epidemic began in the latter half of February 1899, the total mortality during January was, however, every high; but this is explained by Major Reade:—

“(3) During January and February 1899, measles and influenza were prevalent in epidemic form, causing a large mortality amongst the young and the very old, also their sequels, pneumonia and bronchitis. In January 1899, the monthly mortality of the town was 385, and for the sake of comparison it will be convenient to take January 1896, which was a year free from plague, at least the early portion of it. In January 1896, the monthly mortality was 259, but this excluded still-born children, of whom 24 are included in the January 1899 statistics; this would lower the number in the latter year to 361.

The mortality of children under five years of age during January 1899 was 208, whereas in the corresponding month of 1896 it was only 59. The deaths in this class alone would more than account for the increased mortality, not reckoning the 24 still-borns which are included in the 1899 statistics.

(4) A plague epidemic does not take its start amongst persons of this age, but commences in the vigorous adult class, who move about seeking work, and are therefore more exposed to zones of infection. It is quite inconceivable that undetected plague could have existed in the town and not be detected by the medical officers on corpse-inspection, as it must be remembered that these officers were specially skilled in the work, and it was largely owing to the thoroughness with which this work was carried out that cases of plague had been detected and limited in their spread in the preceding ten months. To suppose that an epidemic of plague can exist in the town with a selective agency for children under 5 years of age, and showing none of the objective features of the disease, would certainly revolutionize our present knowledge of the disease. If additional data are necessary to dispel the suspicion that the increased mortality we suffered from in Poona during the early months of this year was due to plague, they could be found in the immunity from plague in the Cantonment and neighbouring villages.

(5) If the excess mortality had been due to plague, it would mean that over a hundred deaths in the month were unrecognized, and that no precautions were taken; and this non-recognition of the disease would surely have led to an outbreak in the neighbouring Cantonment and villages.

(6) For a clear comprehension of this subject it has been necessary to devote some space to the subject; it is a matter of considerable importance, as an increased death-rate in a town which is exposed to plague infection is usually the danger flag preceding an epidemic; but with a reliable death registration, this signal of danger would be recognised on the first imported case of the disease coming into the town.

(7) During the month of February, after the town had been infected with plague, the mortality amongst children was less: whereas the mortality amongst adults was greatly in excess, this excess being due to plague.”

Of the origin and gradual spread of the outbreak, Major Reade gives the following description:—

“The present outbreak of plague commenced early in February, and can be traced to an imported case from Bombay, the illness for several days being concealed. The servant of a Bhatia merchant came from Bombay, but it is not known whether he was ill at the time of his arrival or in the incubation stage of the disease. Just before his death, he was removed from his master's house, 638 Sadāshiv Peth, to 191 Shukrawār Peth, where he died of plague on February 12th. On examination of the corpse the death was pronounced to be due to plague. On the 13th of the same month the daughter of the Bhatia merchant died of plague in her father's house in Sadāshiv Peth.

(8) A woman died of plague in a house on the opposite side of the street; and on the 14th another inmate of the same house was attacked with plague and died in the General Plague Hospital on the 19th, and a third inmate was attacked on the 16th, and died on the 20th. Cases of plague occurred in numbers 634, 602, 645, all of these being neighbouring houses, 82 Shukrawár, a house on the opposite side of the street, next became infected and the inmates removed to 649 Sadáshiv Peth, where four of the inmates were attacked with plague. Houses 650, 659 and 499 in the same Peth became also infected, the affected inmates being removed to the General Plague Hospital.

(9) Shukrawár Peth, which is only divided by a narrow lane from Sadáshiv, also became infected, and 9 cases occurred in a house close to the originally infected house in Sadáshiv Peth. Twenty-five cases occurred in houses bordering on the lane which divides these two Peths, the starting point being the imported case in 638 Sadáshiv Peth.

(10) In the course of a few days the disease was completely stamped out of the infected area in Sadáshiv and Shukrawár Peths.

(11) Raviwár and Budhavár Peths next became infected—probably by fugitives from the infected quarter. The plague organisation in this part of the City was unfortunately weak, and we had in addition to contend against a good deal of concealment, specially amongst the Marwadi and Bannia classes.

(12) The eastern portion of Shukrawár next became infected; in this part the weaver class suffered most. The Bhora community inhabiting the northern portion of Raviwár also suffered considerably. Amongst this caste, there was at first an inclination to conceal cases of the disease, and this disinclination to report cases of illness was attributed by the leaders of the community to the aversion of the Bhoras to going into a General Plague Hospital, and also the fear that the purdah of their women would be disturbed under the ordinary rules of segregation.

(13) To meet this want, and to remove as far as possible all motive for concealment of plague, a Bhora plague hospital was established in Bhawáni Peth, and huts were erected in the compound round the hospital for the accommodation of the contacts of the community.

(14) The establishment of the hospital and segregation camp was attended by the happiest results, as it removed all motive for concealment, and shortly after this change was brought about, the Bhora community ceased to suffer from the disease, owing to the promptness with which cases of plague were reported.

(15) Shukrawár, Raviwár, and Budhavár were the three Peths where the disease showed any disposition to become epidemic, and cases occurring in other parts could usually be traced to importation from one or other of these divisions, and these were promptly limited in their spread. The Peths which suffered most severely in the present outbreak were not the parts which suffered most in the epidemic of 1897-1898, with the exception of Shukrawár Peth, which suffered severely in both outbreaks.

(16) In the epidemic of 1897-1898 Somwár, Mangalwár, Raste, Sadáshiv and Shukrawár were badly infected with the disease; but in the present outbreak Somwár, Mangalwár and Raste have been practically free of indigenous cases, the cases from other parts of the town which were imported into them having been at once limited in their spread.

(17) In those Peths of the town inhabited by people of the better class, and where the plague measures are administered carefully and intelligently, the result of the operations has been most successful.

(18) In Shanawár Peth, with a population of 5,000, 49 cases of plague have occurred during the last five months; 21 of these cases had a permanent residence in the Peth, but with a history of outside contact. Twenty of the cases were imported into the Peth from other parts of the town, and 8 cases from elsewhere outside the town. In no instance has there been any spread of the disease amongst the 'contacts,' and no recurrence of plague in an infected house after the disinfecting process had been carried out.

(19) In Narayen, with a population of 4,500, the results have been even better, and no spread of the disease has occurred.

(20) In Sadáshiv and Budhavár after the initial infection from which these Peths suffered, the results have been very good."

The monthly figures from February to June 1899 for both City and District were as follows :—

Month.					Poona District (excluding Poona City).		Poona City.		REMARKS.
					Cases.	Deaths.	Cases.	Deaths.	
July	1898	56	43	2	2	23 places infected in all.
August	"	...	...	...	176	148	8	6
September	"	...	...	...	435	329	9	4
October	"	...	...	...	632	458	7	3
November	"	..	...	...	370	317	3	...
December	"	...	...	..	182	151	10	6
January	1899	...	...	...	115	89	3	3
February	"	...	...	...	77	58	50	38
March	"	...	...	...	80	67	472	464
April	"	...	...	...	29	23	362	296
May	"	...	...	...	24	17	275	224
June	"	...	...	...	25	15	482	385
Total ...					2,201	1,715	1,683	1,431	

A Chart showing weekly Plague mortality in Poona District is given overleaf.

SATARA DISTRICT.

Area	4,987 sq. miles.
Population in 1891	1,225,989.
Density of population... ..	245·84 per sq. mile.
Rainfall	Average 50 inches.

Sátára is bounded on the north by the States of Bhor and Phaltan, and beyond them by Poona; on the east by Sholapur and the Jath State; on the south by Belgaum and Kolhápur; and on the west by the Kolába and Ratnágiri District.

Boundaries.

In the west water is fairly abundant. In the east, hot weather after hot weather, and want of water causes much suffering. The supply comes partly from rivers and streams, partly from reservoirs, and partly from wells, which are numerous, but in many cases run dry during the hot season. The Sátára climate is a marked change from the moist and relaxing Konkan. It is liable to aggravate fever and render it more acute by contracting the surface vessels and forcing inwards an increased flow of blood. The adverse condition is limited to the dry season, or at least is considerably modified during the soft mild and damp south-west monsoon.

Climate and natural features.

The soils of the District belong to three main classes, red in the hills and black and light-coloured in the plains. The soil of the Krishna valley is especially rich.

About thirty-three miles north-west of Sátára, is Mahábaleshvar, the chief sanitarium of the Bombay Presidency.

Previous epidemics. There is no previous authentic record of plague in Sátára.*

First Epidemic (October 1896—June 1897).—The Sátára District, one of the earliest attacked in the whole Presidency, fell a prey to plague while it was yet suffering from a famine of great severity. Imported plague was reported in the District as early as October 1896, during which month 4 cases (all fatal) occurred. These were followed by 25 cases—21 deaths—in the month of November 1896. But only in a few instances did these cases communicate infection, though precautions of any kind were almost wholly absent. Thus in January and February 1897, indigenous plague broke out in the villages of Sangwi (Koregaon Táluka) and Akhade, Waluth, Panas and Khadshi (Jáoli Táluka), the infection having been imported from Bombay. Of these places, Sangwi, Akhade and Waluth suffered somewhat severely: but the villagers camped in the fields of their own accord, and the plague died out in a short time. A few more cases were imported in March and in the first week of April 1897.

Sátára District.

Population—225,989.

No more was heard of plague in the District until it broke out at Karád in July with terrible severity: and with the above cases, therefore, the epidemic in the Sátára District may be said to end. The figures were as follows:—

* *Bombay Gazetteer*, Vol. XIX.

Month.				Cases.	Deaths.
October	1896	...	...	4	4
November	"	...	...	25	21
January	1897	...	...	8	8
February	"	...	...	28	15
March	"	...	...	15	15
April	"	...	...	6	6
Total				86*	69*

Second Epidemic (June 1897—June 1898).—Alike in its inception and progress, the history of plague in Karád Town is a startling one. Plague was not declared existent until the 7th July 1897 ; and in view of that fact, the following statement made by Captain J. B.

Karád Town.
Population—12,086.

Smith, I. M. S., is not without significance :—

“ Plague was reported by Mr. F. B. Young, Superintendent of Land Records and Agriculture, C. D., as existing in the end of January, or beginning of February 1897, in the following places in the Karád Táluka :—

Karád	...	...	1	1
Khadshi	...	...	2	2
Wahagaon	...	...	1	1
Chore	...	...	7	7
Belavada	...	...	2	2
Páli	...	...	4	4

“ Mr. Young’s tour in the Sátára District lasted from 10th January to the 17th February 1897. He did not see any of the cases himself, and could not state if there were any buboes.”

Nevertheless, subsequent events, coupled with the steady rise in the total mortality, appear to justify the view that this was really the beginning of plague in Karád ; and that, though it took some time to fully develop, it was undoubtedly active in March and April 1897, doing its deadly work long before it was recognized. The average mortality during the previous five years appears in striking contrast with the actual mortality during 1897 :—

				Actual, 1897.	Average.	REMARKS.
March		30	21	For four years only (excluding 1894, when there was cholera).
April	...	...		40	21
May	...	..		108	29
June	...	...		52	25
July	...	...		213	24

The heavy rise in the mortality could not but give rise to alarm. People began to suspect that a disease which did not simultaneously break out in several parts of the town, but attacked one locality after another, and which claimed so many victims, was no ordinary one. Rumours soon arose that it was plague : and in May a resident of Karád wrote to

* Mostly indigenous.

the Collector that there was plague in the town. The Mámlatdár of a neighbouring Táluka even complained of it. The Collector called for an explanation. The Mámlatdár consulted his Hospital Assistant, who, having no previous experience of plague, gave it as his opinion that the disease then existing was not plague but remittent fever, which generally prevailed at that time of the year. The improvement in the mortality in the month of June was also calculated to conceal the identity of the disease. But the common belief in the existence of plague in May naturally led the people to think of the measures that would be adopted for its suppression; and a vague fear of those measures may have led to the concealment of deaths. Such, at least, is the explanation given by Major Baker, I. M. S., Plague Inspecting Officer, of the decrease in the mortality during June. Doubtless, an inadequate system of death registration rendered evasion quite possible.

But the disease soon asserted itself in a manner which could no longer be mistaken, and on the 7th July 1897 plague was declared epidemic in Karád. During the first 3 days 5 cases were reported, and, in the week ending 16th July, 26 cases with 14 deaths. A Plague Hospital was opened on the 13th July, and on the 29th Lieutenant K. V. Kukday, I. M. S., arrived in charge of a Plague Flying Column; while Mr. Clements, Second Assistant Collector, supervised the arrangements. Captain Smith observes:—

“Trade was altogether paralyzed; the majority of the municipal members fled. The utter disorganization that prevailed in the town could hardly be imagined by one who had not seen it. It was only by the most strenuous exertions on Mr. Clements’ part that bearers could be had to convey the sick to the hospital, and that food could be obtained for the hospital and segregation camps. Search parties were conducted by Mr. Clements, Dr. Kukday and Mr. Sapre (Municipal Commissioner), aided by Hospital Assistants and School-masters. Dis-infection and white-washing were being carried out by a staff all too small for the work, but labour was not to be obtained locally on any terms, and it was not until a large number of coolies were obtained from Bombay that any headway was made.”

The rapidity with which the epidemic grew worse, as well as the proportions which it attained, can be better illustrated by a statement of attacks and deaths than by any description:—

Week ending					Cases.	Deaths.
9th July 1897	...	...	...	...	5	...
16th "	"	"	...	...	26	14
23rd "	"	"	...	...	30	26
30th "	"	"	...	...	62	43
6th August	"	"	...	...	95	65
13th "	"	"	...	...	117	102
20th "	"	"	...	...	208	149
27th "	"	"	...	...	247	192
3rd September 1897	...	...	...	...	230	186
10th "	"	"	...	...	142	112
17th "	"	"	...	...	101	79
24th "	"	"	...	...	60	46
Total					1,323	1,008

It must be remembered that of the total population—12,086—a large proportion fled; and it will then be seen that, concealment and flight considered, twelve is a low estimate of the percentage mortality, and that considerably more than one-tenth of the actual inhabitants were swept away in less than three months.

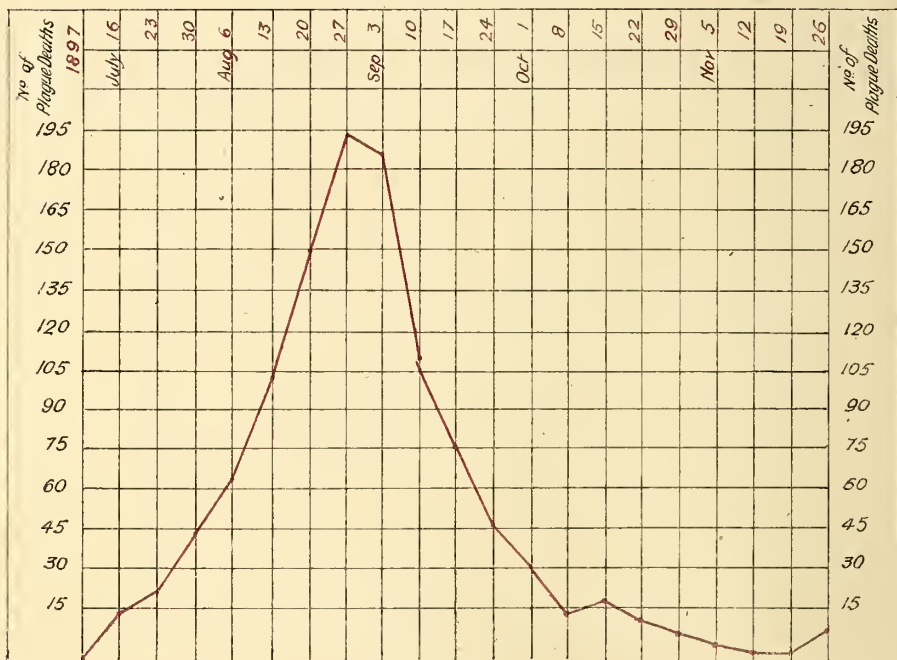
It will be observed from the figures that the epidemic showed signs of declining in the beginning of September. On the 2nd of September, Captain J. B. Smith had relieved Lieutenant Kukday of the charge of the Flying Column; on the 3rd, Lieutenant G.

Robertson, I. M. S., arrived, followed by Lieutenant Garrett, I. S. C., who, however, had to return to military duty within a week. About this time also a Non-Commissioned Officer and six sepoys of the 2nd Bombay Grenadiers arrived ; the staff was otherwise increased, and three European Inspectors were available. The Plague Hospital was extended ; contacts segregated in camps ; house-to-house search instituted ; infected houses systematically disinfected ; and the disposal of corpses without certificates of death prohibited. But the people were terrified : and a wild exodus from the town began, which was ultimately responsible for an outbreak in the villages, as severe as that in the town. The flight of the people, however, accelerated the subsidence of plague in the town itself. In the first week of October there had been 41 cases—30 deaths ; in the last week there were but 7 cases—7 deaths. The largest number of cases in one day was 57 on the 24th August, and of deaths 40 on the 30th August. The total numbers of cases and deaths during October, November and December 1897 were as follows :—

Month.					Cases.	Deaths.
October	1897	...	...	...	106	76
November	"	...	...	...	19	17
December	"	...	...	...	9	6

KARÁD.

Population 13209.



Plague now ceased in Karád Town, and, a few dropping cases excepted, did not re-appear for nearly a year ; and then only in a mild form.

The flight of the people from the Town of Karád, and its effect on the spread of the plague, have been noticed above. There was indeed an
Sátára District.
Population—1,225,989. Observation Camp at Karád, and residents were not allowed to leave the town until the area within 50 yards of their houses had been free for a period

of ten days, but in the absence of effective supervision these precautions were of little practical value. Week after week 10, 12, 15, 20 cases escaped from the town to the villages, and though several were detected by village officers on the borders of their villages, the rest succeeded in disseminating the infection far and wide, not only in the Karád Táluka, but all over the District. So extensive was the spread that in addition to the Flying Column sent to Karád Town, which was gradually made available for the rest of the Táluka, two others had to be organized. Already in September no less than 7 Tálukas were infected; while, of the larger towns, Tasgaon (population, 11,261) was attacked in October, and Sátára (population, 25,750) in November 1897. During the year 1897 as many as 165 villages were infected in the Sátára District; of these, 56 were in the Karád Táluka.

The cases which Karád scattered over the District soon bore evil fruit. In many places indigenous plague established itself, but for some time remained unnoticed. Even the abnormal mortality occurring in consequence in many places either escaped attention, or was attributed to other causes, or, still more often, was concealed. But in August 1897 the state of affairs could no longer fail to attract attention. The abnormal mortality at Kaledhon—an important village in the Khatao Táluka, not far from Karád—was, throughout June and July 1897, attributed to cholera; but at length its true cause was recognized, and plague was declared epidemic on the 1st of August. The pestilence raged here with terrible severity: Kaledhon suffered more grievously even than Karád. In a small population thinned by a panic-born exodus 111 cases were officially recorded during the week ending the 3rd of September 1897: while the numbers concealed were never known. The following week (3rd—10th September) the official record was 123 cases—95 deaths. A Hospital Assistant, with the assistance of Revenue and Police subordinates, under the general supervision of a Táluka Plague Mámlatdár, did what he could. The one effectual measure adopted was that of evacuation. But method was wanting. The people had indeed encamped outside the village site, but were spread over a vast area, either scattered or in groups, sick and healthy, infected and non-infected, all promiscuously intermingled. This confusion was aggravated by almost constant rain.

This state of things was at last remedied by the appointment of a Plague Flying Column, which was sent there in charge of Assistant Surgeon E. S. Bharucha. He arrived at Mayani (which was made the head-quarters of the Column) on the 18th September 1897 and held a conference with the District Deputy Collector, the Revenue Mámlatdár and the Plague Mámlatdár. Next day he started operations at Kaledhon, and the condition of things as described by him is appalling. Some 500 cases and 300 deaths had already occurred. There was a large number of sick, who were scattered in all directions over an area of nearly five square miles.

“There was no hospital for the accommodation of such a large number, nor were there materials available for the erection of one with the promptness that the urgency of the occasion demanded.”

Four vacant houses at the northern end of the village were secured for a hospital, and patients that were in a condition to be removed were collected here, but so large was the number that convalescents had to be turned back.

The District Deputy Collector and Assistant Surgeon Bharucha then called a meeting of the villagers and explained to them the objects of the measures they proposed to adopt. These were simply the separation of the sick from the healthy and the disinfection of houses. But the work of disinfection was unsatisfactory until help arrived from Bombay on the

27th September, when systematic disinfection was taken in hand. On the 20th October 1897 it was complete : over 1,000 houses having been disinfected.

The pestilence disappeared from Kaledhon towards the end of October 1897 : having more than decimated the town in less than two months. The figures reported were 602 cases—452 deaths.

Turning from Kaledhon to the other villages attacked in the Khatáv, Khánápur and Khatáv, Khánápur and Mán Tálukas during this—the second—epidemic, 26 Mán Tálukas. villages in all were attacked in them. The source of infection in most of them was either Kaledhon or Karád. Importation was almost invariably followed by abnormal mortality : but apathy and concealment neutralized the vigilance and efforts of the District Deputy Collector. With the arrival of the Flying Column, however, greater control was possible. Surprise visits were paid to villages and death registers scrutinized. Thus plague was either warded off by prompt attention to imported cases, or detected in an inceptive stage. As the people became better acquainted with its nature, they put forth spontaneous efforts for their own protection, by preventing the entry of people from infected localities ; in many cases with considerable success, of which Vita, Mayani and Pusesávli are conspicuous instances.

The suppressive measures adopted from the beginning of October 1897 throughout these Tálukas were briefly as follows:—

1. Early evacuation of affected villages.
2. Regular and careful search for cases among the people encamped.
3. Removal of patients to small huts built on a selected site ; hospitals being regarded with disfavour by the people.
4. Destruction of the clothes of patients, and of the huts in which cases occurred.
5. Precautions with regard to the disposal of the dead.
6. Disinfection and segregation of inmates of affected huts.
7. Disinfection of whole villages and opening up of houses for admission of sun and air.
8. House-to-house inspection for 10 days after re-occupation.

These measures were attended with a fair amount of success.

The attacks and deaths in each of the three Tálukas were as follows :—

Táluka.				Cases.	Deaths.	REMARKS.
Khatáv (excluding Kaledhon)	...	...	...	332	253	} 26 villages in all attacked.
Khánápur	...	...	...	1,118	900	
Mán	...	...	...	478	347	
				1,928	1,509	
Add — Figures for Kaledhon	...	...	...	596	448	
			Total	2,524	1,957	

The Flying Column under Captain J. B. Smith at Karád has already been referred to. But no sooner was the epidemic in that town controlled, than the villages in the Karád Táluka demanded attention ; and the number of them attacked before the end

of January 1898 in this Táluka alone was 57. In the first week of September 1897, seven villages returned about 100 cases. On the 4th September, Lieutenant Robertson, I. M. S., took charge of the villages in the Karád Táluka and succeeded in several cases in detecting plague at places where it had been carefully concealed. But the extent of his charge largely discounted the efficacy of his endeavours: for whatever good he was able to effect on his arrival at a village, was undone on his departure. Nevertheless, the surprise visits which he paid to villages, and the scrutiny exercised by him over village death registers, acted as valuable checks.

Amongst the places which suffered most severely in the Karád Táluka was the town of Masur, a well-to-do agricultural and commercial centre,

Masur.
Population—6,703.

Masur visited Karád and brought infection thence in the second week of August 1897. During the two succeeding weeks only one indigenous case occurred; but this was soon followed by others. The first few cases all occurred amongst the Rámoshis, who were quickly turned out. Nevertheless infection soon spread to the other classes; and the monsoon prevented general evacuation. Efforts were therefore confined to the isolation and treatment of the sick. Lieutenant Robertson occasionally visited Masur, and Mr. P. E. Percival, I. C. S., Assistant Collector, devoted special attention to it. Later on (in November) it formed the chief part of the charge of Mr. A. D. Wilkins, Divisional Forest Officer, who was constituted a Plague Authority for Masur and the surrounding country. Many of the agricultural and commercial inhabitants left the town, some escaping to other villages and some merely vacating their houses and living in camp. In November 1897, owing to the cessation of the rains, evacuation became practicable and was generally enforced.

As in Karád, as in Kaledhon, so in Masur, disinfection was carried out extensively, All the houses in town—about 1,000—were not only completely disinfected, but had the roof opened up to admit light and air.

The results may be seen in the following figures which trace the progress of the epidemic week by week:—

Week ending				Cases.	Deaths.	REMARKS.
28th August	1897	...		14	7	
4th September	"	...		20	14	
11th "	"	...		15	15	
18th "	"	...		31	27	
25th "	"	...		17	7	
2nd October	"	...		30	26	
9th "	"	...		25	18	
16th "	"	...		57	51	
23rd "	"	...		67	63	
30th "	"	...		75	75	
6th November	"	...		48	48	Evacuation pro- ceeding.
13th "	"	...		40	40	Evacuation com- plete.
20th "	"	...		24	22	
27th "	"	...		8	7	

The total number of cases at Masur was 498 and of deaths 442. Two months after the occurrence of the last recorded case, re-occupation was permitted; this produced no evil consequences, as there was no recurrence of the disease in Masur for over a year.

The history of plague in the rest of this Táluka was at first the same. In August 1897, 2 Hospital Assistants were available for work in the villages. Two more were added in September after Lieutenant Robertson started work. But in October, 2 of these were withdrawn and were only replaced in November by 4 military medical pupils. As, however, the plague still spread, the Táluka was divided into 4 sub-divisions, an officer being placed in charge of each. Captain Keown, Lieutenant Daunt, Lieutenant Steen, and Mr. A. D. Wilkins, Divisional Forest Officer, were made Resident Plague Authorities, and the 2nd Assistant Collector, Mr. P. E. Percival, was Chief Plague Authority for the whole Táluka. In November the staff was further augmented by the arrival of Dr. H. W. Beach, English Doctor. Measures were now energetically enforced; with the cessation of the rains, evacuation became possible and was everywhere carried out; the epidemic was brought under control.

The approximate numbers of cases and deaths in the Karád Táluka from August 1897 January 1898 were as follows:—

Month.				Cases.	Deaths.
August	1897—4 weeks	...	...	104	74
September	" —4 "	...	...	718	454
October	" —5 "	...	...	2,845	2,142
November	" —4 "	...	...	2,188	1,866
December	" —5 "	...	...	763	631
January	1898—4 "	...	...	117	97
Total				6,735	5,264

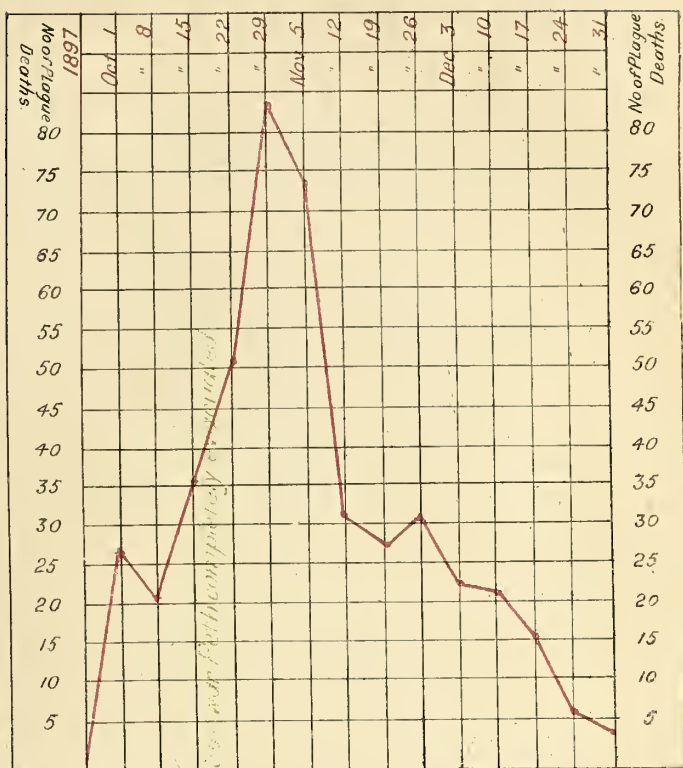
The largest number of cases recorded in one week was 685 (week ending 23rd October 1897) and of deaths 605 (week ending 13th November 1897). The epidemic came to an end in February 1898.

Tásgaon was attacked on the 13th September 1897, but official report was not made till the 25th of the same month, and in the week ending 1st October 1897 there were no less than 35 cases and 26 deaths. The District Deputy Collector, Ráo Bahádúr B. R. Heblíkar, arrived about this time at Tásgaon. He turned out the population of the whole of the Somwár Peit, and arranged for the construction of hospital sheds, etc. A Plague Flying Column, in charge of Assistant Surgeon Merchant, was also sent, and arrived at Tásgaon about the 1st October. The following week there was a decrease (27 cases—19 deaths): but several of the evicted people had been infected and succumbed in the fields. The result was an increase in the number of cases. Meanwhile, infection had spread in the town itself, and in the week ending 29th October 1897, the highest figures of this epidemic—110 cases, 83 deaths—were recorded. The staff comprising the Column was fully occupied with the town and could give but little attention to the evicts, scattered, as they were, over a wide area. House-to-house search was instituted: patients were removed to hospital; contacts were segregated for 10 days; and the occupants of neighbouring houses were turned out into the fields, the houses themselves being disinfected. Later on, the same procedure was observed with regard to the people in the fields. Such were the suppressive measures adopted. The characteristic features of this Tásgaon epidemic—moderate virulence and slow and gradual decline—are apparent from the subjoined statement:—

TASGAON TOWN

Population 11,261.

Week ending	Cases.	Deaths.
1st October 1897	35	26
8th " "	27	19
15th " "	35	31
22nd " "	51	48
29th " "	110	83
5th November "	75	71
12th " "	53	50
19th " "	41	27
26th " "	47	30
3rd December "	23	22
10th " "	18	20
17th " "	11	15
24th " "	5	6
31st " "	2	3
7th January 1898	1	1
14th " "	1	1
Total ...	535	453



No case was reported after the 14th January 1898.

From the Town to the Táluka was but a step. There was little restriction on the movements of the townspeople, and their dispersion led to an outbreak all over the Táluka. But unlike most other places in the District, the people left the village directly cases occurred among them, and, in fact, in some instances before plague was notified. This action had the very beneficial result of limiting the number of attacks. Out of the 20 villages attacked in Assistant Surgeon Merchant's charge, only two had not been so evacuated, *viz.*, Chinchni and Bhose. The former, with a population of 3,155, had 255 attacks and 204 deaths; the latter with a smaller population—2,445—had very nearly the same proportion of cases and deaths, *viz.*, 188 and 144 respectively. In other words, about 8 per cent. of the population were attacked in these two villages. On the other hand, in the evacuated villages the attacks were in all cases, except that of Doongersoni, under 4 per cent. of the population, being less than 2 per cent. in 9 cases. In Doongersoni alone the proportion was over 9 per cent., doubtless due to tardy evacuation. There was a general subsidence towards the end of the year 1897, but fresh villages were attacked and the epidemic lingered on in this Táluka after the disease had subsided everywhere else in the District. This is attributed to the continued outbreak in the Southern Marátha Country whence infection was freely brought into Tásgaon. In any case plague did not die out in Tásgaon Táluka during the hot weather, and was ultimately responsible for the third epidemic in the District. Up to the end of May 1898 there were 1,218 cases and 946 deaths in the Tásgaon Táluka, exclusive of those in Tásgaon Town.

Plague in the Sátára District had already reached its zenith in October 1897, and a

Sátára Town.
Population—29,601.

marked, though gradual, decline had set in in the month of November 1897, when the town of Sátára was attacked. The

first imported case had come from Bombay, and occurred on the 10th January 1897, but was not allowed to establish infection; 5 more cases were imported in February, but were

successfully isolated. In this month Mr. C. B. Winchester, I. C. S., the Collector, called a meeting of the citizens and impressed on them the necessity for a close watch over further importation. The town was divided into 9 wards, two Municipal Commissioners holding charge of each ward. As, however, more cases occurred in March, and there was every prospect of their increasing, observation posts were established on the roads leading into the city, for the purpose of keeping ward superintendents informed of the name and address of every arrival. Two Observation Camps supplemented these measures on the 9th April 1897. These camps were closed on the 1st of June; but the surveillance system was continued.

But, with the fall of Karád, the protection of Sátára became increasingly difficult: and in November 1897 Sátára Town was numbered amongst the fallen. The history of the first few cases is both interesting and instructive. In September 1897, 2 or 3 cases occurred in the house of a man who had frequent dealings with Karád. This man's house formed one of a block of seven or eight houses, separated from the rest of the town by a *nullah*. The inmates were segregated and the house thoroughly disinfected. Some 12 days later a case occurred in another house of the same block. This case was followed by 2 others in a third house, also situated in the same block. This isolated block was now strictly cordoned for 15 days, and its residents were carefully examined every day. On the 4th of November, that is, a month after the occurrence of the last case, yet another person succumbed to plague in the same block. Meanwhile, a resident of the block, who had been allowed to shift his quarters to another part of the town, developed plague there. Thereupon, all the houses in which cases had occurred—4 in number—were burnt down; and the whole of the cordoned inhabitants segregated in the Farashkhana (about the 9th November 1897); but, 2 cases occurring among them next day, they were again moved to yet another place.

On the 12th November a second centre of infection was discovered: 4 cases occurred in a house not far from one of the infected houses in the block, but situated in the town proper. A large block of about 200 houses was then cordoned; those who wished to leave their houses being allowed to do so after passing 10 days in the Observation Camp. Plague now broke out quite unexpectedly in the heart of the town; but was discovered in good time, and the part in which it was found was also cordoned. But all efforts to stop the plague were in vain: two fresh centres were formed equally insidiously; and in the early part of December 1897 plague was declared epidemic at Sátára Town.

During the previous month Ráo Bahádur B. M. Heblikar, Deputy Collector, had been appointed Chief Plague Authority. A Plague Hospital had already been erected in January 1897; and a Segregation Camp was now attached to it. This Hospital and Camp were, from first to last, in charge of Captain G. Thomson, I. M. S., Civil Surgeon. On the 1st of January 1898 another Hospital, with a Camp attached, was added, and was placed under Dr. Walton, who, after a few days, was relieved by Dr. Beach. Six divisions of the town were made, each division being placed under a European officer.

House after house and block after block were evacuated; but the plague still spread, and every part of the town—at least, the town proper situated on the northern slope of the Ajimtara Fort—was infected. Mr. Kharkar's remarks on its dissemination are interesting:—

“It commenced south-west and ended north-east in the village of Karanja. It was a peculiar circumstance that the plague took the direction of the *nalas* that run down the hill fort through the City and past the village of Karanja. There is another circumstance very peculiar: although there was plague in every quarter of the town, there was not a single case in the Dhor (Tanners') quarters. The group of about 50 houses of the Dhors, with tanneries attached, formed a sort of oasis in the heart of the virulent plague field. Dr. Thomson, on one or two occasions, expressed his opinion that the Dhor quarters enjoyed this immunity because the stink of tanneries killed the plague germ.”

Although complete evacuation was not enforced, large numbers of people were turned out, and at one time the people in the town numbered but 3,000. Thorough disinfection of every house in the town was carried out under a system which gave no cause for complaint. The property of absent owners was carefully secured.

In the month of October 1897, there were 3 cases and 2 deaths, and in November 24 cases with 17 deaths: thereafter the monthly figures are given below—those for January 1898, the worst month, being given in detail:—

Month.	Cases.	Deaths.	REMARKS.
December 1897—5 weeks	193	147	{ 7th ... 78 69 14th ... 93 76 21st ... 89 74 28th ... 79 68
January 1898—4 „ ...	339	287	
February „ —4 „ ...	110	105	
March „ —5 „ ...	43	36	
April „ —1 week	2	3	
Total ...	687	578	

Plague practically ceased at the end of March 1898; although in April there were 2 cases and 3 deaths. A census of the people in camp was taken in this month, and re-occupation was permitted on the 20th May: those not shown on the census lists or not certified to have lived in uninfected localities being first detained outside the town for 10 days.

From April to June 1898 there was comparatively very little plague in the Sátára District.

The characteristic features of this epidemic were its duration, and the large number of places attacked. This second epidemic lasted for about a year—May 1897 to April 1898—and 217 places were attacked. The monthly figures for the whole District, including all the towns and villages, are given below:—

Month.	Cases.	Deaths.
July 1897	123	77
August „	898	416
September „	1,725	1,270
October „	4,182	3,150
November „	3,646	3,144
December „	2,154	1,739
January 1898	962	805
February „	505	406
March „	356	264
April „	146	119
May „	124	102
June „	55	45
Total...	14,876	11,762

Third Epidemic (July 1898—June 1899).—The subsidence of the second epidemic practically coincided with the commencement of the third. Several places in different Tálukas were attacked in June and became worse in the succeeding months. But no considerable

town was infected until September 1898, in which month Limb and Khánápur were attacked one after another. Khánápur, with a population of just over 5,000, escaped lightly with 73 cases and 58 deaths. But Limb was not so fortunate: with a smaller population (4,593) it contributed no fewer than 546 cases with 437 deaths in a period of 6 months. It took nearly 2 months to get this town evacuated; but evacuation does not appear to have been as successful here as at other places.

Towards the close of September 1898 the Town of Uran and Islámpur was infected by Peth, a considerable town in the same Táluka with a population of some 6,500.

Uran and Islámpur.
Population—10,657.

Blocks of houses were evacuated as infection appeared, until the entire Uran division of the town lay empty. Even then cases occurred amongst the people in the fields, the deaths averaging 3 or 4 daily up to the middle of December. The first case in the Islámpur division of the town occurred on the 10th November 1898, the pestilence having apparently crept steadily forward from Uran. This division of the town was also ultimately evacuated: but the disease lingered in this locality for a long time, the monthly figures being as follows:—

Month.	Cases.	Deaths.
September 1898	2	1
October „	74	52
November „	137	118
December „	105	101
January 1899	29	23
February „	16	15
March „	5	3
Total..	368	313

Karád and Ashta excepted—and they were soon to follow—every town of importance had suffered more or less severely in the third epidemic, while Sátára still remained free.

Sátára Town.
Population—29,601.

The most strenuous efforts to ward off a second epidemic were put forth: all arrivals were placed under surveillance: Major T. R. Montgomery, I. C. S., who in October 1898 gave place to Lieutenant-Colonel H. Hay, I. S. C., was placed in charge of precautionary measures: when villages in the Sátára Táluka became infected, no one was permitted to enter the town without a pass, and all comers from infected places were rigorously excluded: fruit and vegetable markets being held outside the town.

But in spite of all precautions plague eventually effected an entrance, first attacking a small village within the limits of the Sátára Suburban Municipality. Although the village was promptly evacuated, infection was communicated to the town and resulted in an outbreak. It is noteworthy that those parts which had escaped formerly were chiefly the ones to suffer now. The rise and progress of this epidemic is thus described by Lieutenant-Colonel Hay:—

“The epidemic in Sátára City began on the 7th October 1898. The first serious outbreak occurred in a Peth called Pantachagote; seven cases occurred there in the week ending 3rd November 1898. Eight more cases occurred there in the same Peth in the following week, after which the whole Peth was evacuated, after which plague ceased there. After plague had made its appearance in Pantachagote it similarly began in two more Peths called Raviwár and Malhár. These two Peths are in the vicinity of Pantachagote, and the infection was, no

doubt, imported from the latter. Raviwár Peth had 14 cases, and Malhár Peth had 26 cases in all. The plague in Malhár continued for a long time, *viz.*, October to the end of January 1899, thus endangering the safety of adjoining Peths, although repressive measures, such as evacuation of blocks, were actively and promptly carried out. While plague was running its course in Malhár Peth, the disease appeared in the adjoining Peth called Guruvár. It began in Guruvár in the second week of December 1898 and continued up to the week ending 28th January 1899, recording 32 cases in all, which was the largest number recorded in the history of all the infected Peths. From Guruvár the plague was imported in the adjoining Peth of Shanvár. It began in Shanvár in the week ending 13th December 1898, and ended in the week ending 14th March 1899, 9 cases in all having occurred. From Shanvár the disease appeared in the neighbouring Peth of Bhaváni; only 2 cases occurred in the Bhaváni Peth, after which plague was practically over in the City."

The Hospitals and Camps established during the previous epidemic were re-opened, patients and contacts segregated, and evacuation of infected houses and of blocks of houses, large or small, according to circumstances, and even of whole Peths, was vigorously enforced. Doubtless, added experience and more stringent measures assisted in mitigating the severity of the epidemic: but, whatever the reason, Sátara suffered far less severely in this epidemic than in the previous one, as the following figures demonstrate:—

Month.	Cases.	Deaths.
October 1888	6	3
November „	49	35
December „	29	27
January 1899	17	15
February „	34	27
March „	9	8
Total ...	144	115

At about the same time as Sátara (October 1897), the town of Karád succumbed, Karád. although every endeavour was made to prevent its re-infection. Population—12,086. Each case as it occurred was followed by the evacuation of several adjoining houses, but without avail. Towards the end of December 1898, therefore, a large part of the town was ordered to be evacuated; and some 2,000 people left the town. Up to the 19th January 1899, no further case occurred. On that day a case developed itself in a house on the very edge of the evacuated quarter. Another large block was emptied, and plague then ceased in the town; although some cases occurred in camp. At the end of March 1899, the town was re-occupied. Four more cases occurred up to 7th May 1899, but these were merely sporadic cases and did not cause any alarm. The epidemic was a very mild one. The following are the figures:—

Month.	Cases.	Deaths.
November 1898	9	8
December „	19	17
January 1899	21	14
February „	8	7
March „	5	4
Total ...	62	50

Ashta.

The town of Ashta, with a population of over 11,000, was

Population—11,403.

now attacked for the first time.

The first 2 cases of plague in Ashta occurred on the 16th December 1898; the origin, as usual, being obscure. By the 26th of December 4 more cases had occurred, and a large block of 100 houses was promptly evacuated. Up to the 16th January 1899 no more cases were reported; but after that date cases again began to occur—the first few on the outskirts of the evacuated block. Large blocks of from 50 to 100 houses were now emptied; but evacuation did not keep pace with the spread of the disease. Ultimately (about the 7th of February 1899) the whole town was evacuated; a large Segregation Camp being ready by the 17th February, which proved very successful. This Camp was constantly guarded by police, and was in the medical charge of a Hospital Assistant who arrived on the 5th February. The houses in the town were unroofed by paid coolies.

The plague operations in the town of Ashta and the Segregation Camp abovementioned were both under Lieutenant H. C. Steen, I. S. C. They were both highly successful, as the following figures show :—

Month.	Cases.	Deaths.
December 1898	4	2
January 1899	5	3
February „	30	28
March „	52	40
April „	20	19
May „	9	6
Total ...	120	98

Tásgaon.

had occurred in the town. About the 19th February 1899,

Population—11,261.

cases occurred in a detached quarter, and, in March, infection spread to the remainder of the town. Large blocks of houses were ordered by Lieutenant Steen, who was in charge of the operations, to be evacuated, but owing to opposition, and to the weather, which in the early part of April was abnormally inclement, evacuation measures were relaxed. The consequence was a rise in the figures and increasing spread. Complete evacuation was now decided on and was carried out during May: but at the end of that month, the town was still on the infected list. Up to that date the following numbers of cases and deaths had occurred :—

Month.	Cases.	Deaths.
February 1899	11	7
March „	73	66
April „	42	31
May „	88	68
Total ...	214	172

The number of places infected in the third epidemic was very large—240—considerably more than were infected in the previous epidemic. But, on the whole, the outbreak, though

wide in extent, was limited in virulence. This was doubtless, to some extent, due to the increasing adoption of evacuation, which was carried out completely in 127 villages.

Every effort was made in the Sátára District to popularise inoculation ; but with little success. In Sátára Town and Camp 1,173, and in the rest of the District only 512, inoculations were performed. Of these 1,685 inoculated people, only three were attacked by plague.

There were several instances of plague occurring on re-occupation, even after the houses re-occupied had been disinfected ; these instances were houses which had not remained vacant for any considerable time. Lieutenant N. R. Anderson, I. S. C., quotes Kamatipura and a Government building adjoining the jail in Sátára Town as examples. Ventilation and admission of light and air by partial unroofing was freely resorted to : except in the case of flat-roofed houses, in which any action short of complete unroofing was ineffective, and did much damage.

In this connection, the following observations by Mr. C. G. Dodgson, the Collector, are both valuable and interesting :—

“The plan which I have followed is to permit re-occupation 2 months after the last case of plague and between 3 or 4 months after evacuation. The method employed is to allow the houses to be first repaired (*i. e.*, roofs mended) and thoroughly cleaned. One person is then allowed to sleep in each house. If after 10 days none of the people sleeping in the village are found to be ill entire re-occupation is permitted. The results have been satisfactory, as infection has not broken out again in a single instance. As far as my experience goes, it makes no difference whether the houses have been disinfected with chemical disinfectants or not, as in no house has plague broken out again, *provided that the house had been empty for at least 3 months*. Where houses were chemically disinfected and re-occupied after a lapse of, say, a fortnight, plague has broken out on more than one occasion. I am inclined to think that even if houses had not been ventilated at all but had merely been left vacant for, say, four months, that the germ would be found to have become innocuous. In many cases the lower stories of upper storied houses have not been capable of ventilation and still re-occupation has done no harm. The rule which I have stated above has not always been rigorously followed, some villages having been re-occupied after a lapse of not more than two months.”

The following statement shows the total numbers of plague cases and deaths throughout the District during the whole of the third epidemic :—

Month.					Cases.	Deaths.
July	1898	...	...	...	248	220
August	„	...	...	...	432	305
September	„	...	...	...	1,229	872
October	„	...	...	...	2,265	1,892
November	„	...	...	...	2,219	1,847
December	„	...	...	...	1,362	1,069
January	1899	...	...	...	970	787
February	„	...	...	...	705	628
March	„	...	...	...	583	497
April	„	...	...	...	163	150
May	„	...	...	...	221	175
Total					10,397	8,442

The strictest precautionary measures were adopted for the protection of the important hill-stations of Mahábaleshvar and Pánchgani, and it is a matter for congratulation that throughout the long period during which plague has lasted in the District, these stations have been kept quite free.

The Aundh State went through two epidemics, both more or less severe. The *first* Aundh State. epidemic, which began about the end of August 1897, lasted till the beginning of April 1898—the small town of Aundh itself (population, 3,248) suffering from the middle of October 1897 to the end of December 1897. The following are the figures for the epidemic : —

Population—65,146.

Month.				AUNDH. Population 3,248.		OTHER PLACES.	
				Cases.	Deaths.	Cases.	Deaths.
August	1897	...	...	...	...	2	2
September	"	...	...	...	...	13	5
October	"	...	...	38	12	55	32
November	"	...	...	126	122	181	123
December	"	...	...	56	25	211	136
January	1898	...	...	...	...	76	61
February	"	...	...	...	...	50	37
March	"	...	...	...	...	43	39
April	"	...	...	...	...	2	2
Total				220	159	633	437

The *second epidemic* in Aundh State commenced on the 21st August 1898, at the village of Alsand. For five weeks the disease was confined to this village ; but thereafter it spread wider and attacked ten villages ; the last being attacked on the 12th April 1899 ; since which date no fresh villages have been infected. Aundh itself remained free during the second epidemic. Eight villages were completely evacuated with good results. Although the epidemic as a whole lasted for a period of nine months, in only one case did plague continue in a place beyond three months. The following statement shows the cases and deaths for this epidemic :—

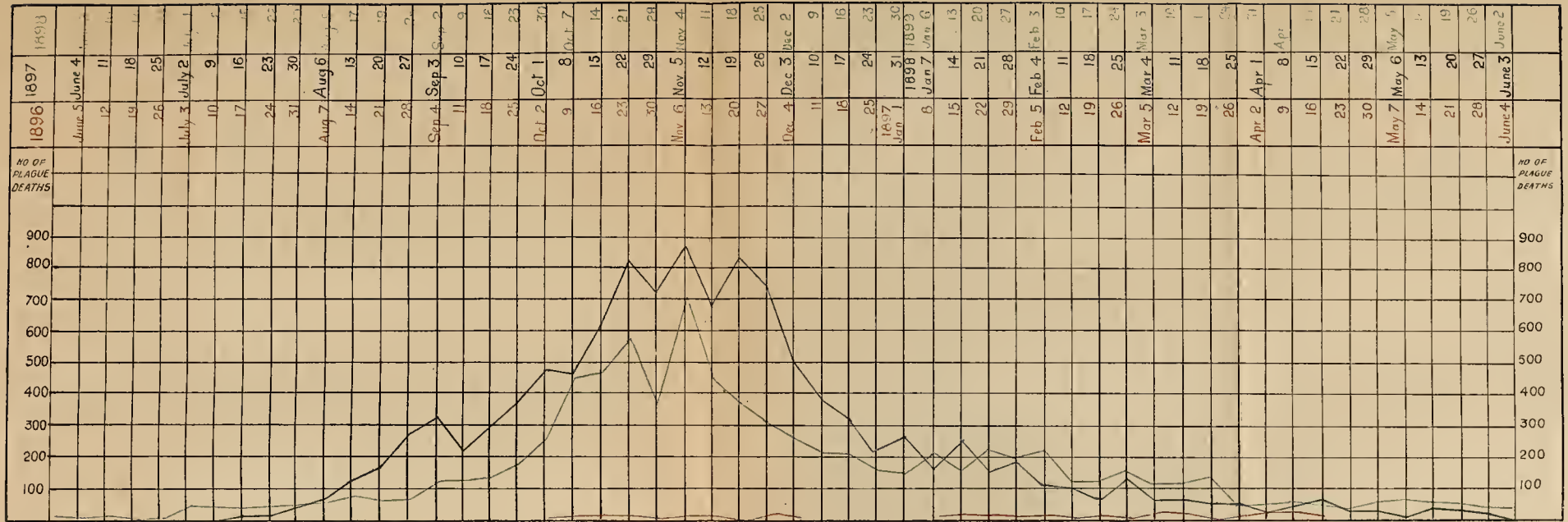
Month.			Cases.	Deaths.
September	1898	...	65	43
October	"	...	119	85
November	"	...	177	121
December	"	...	378	280
January	1899	...	113	78
February	"	...	10	14
March	"	...	16	11
April	"	...	15	10
May	"	...	1	2
Total			894	654

Phaltan State.
Population—66,383.

The Phaltan State has throughout been free from plague, with the exception of an imported case or two in February 1897.

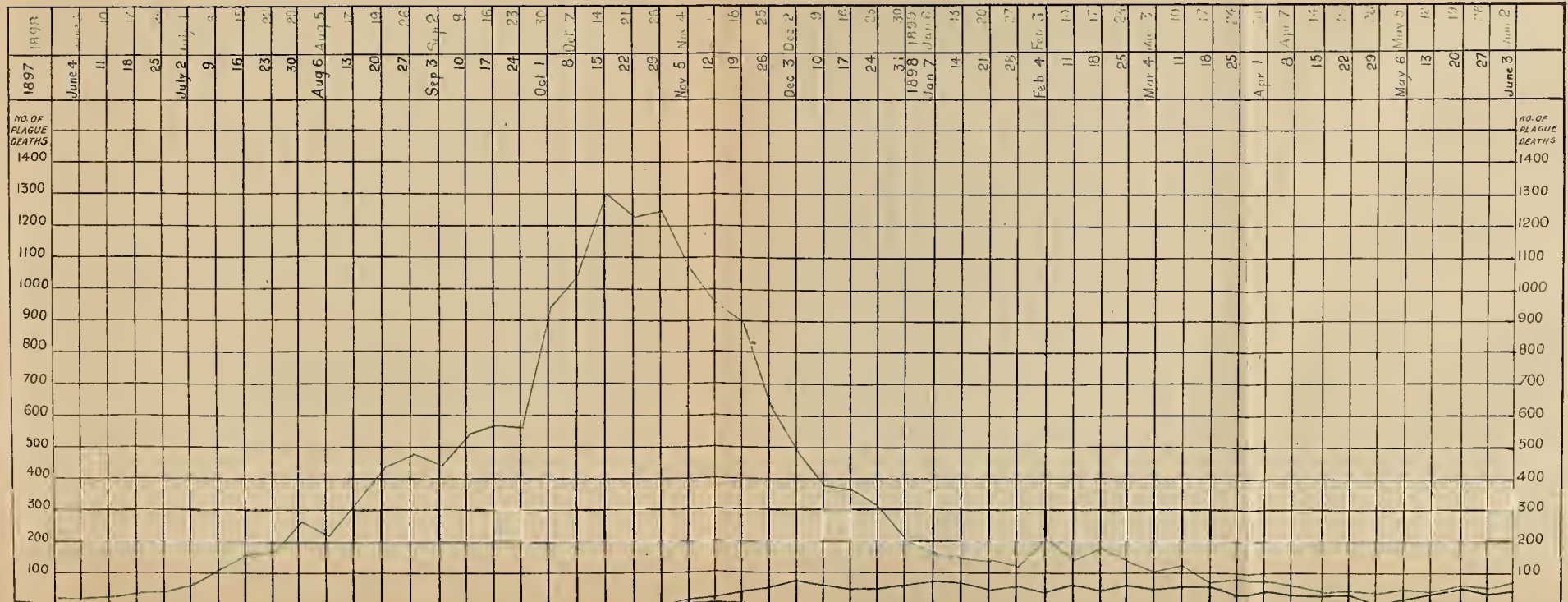
SATARA DISTRICT.

Chart showing Plague Mortality.



BELGAUM DISTRICT.

Chart showing Plague Mortality.





SHOLAPUR DISTRICT.

Area	...	...	...	...	...	4,542 sq. miles.
Population in 1891	...	...	...	...	...	750,689.
Density of population	...	...	...	...	...	165.28 per sq. mile.
Rainfall	...	...	...	...	...	25 inches.

Sholapur District is bounded on the north by Ahmednagar and the Nizam's territory ;
 Boundaries. on the east, by the Nizam's territory and the Akalkot State ; on the
 south, by the river Bhima, the District of Bijapur, and the Patvar-
 dhan and Jath States ; and on the west, by Atpadi, Sátára, Phaltan, Poona, and Ahmed-
 nagar. The District outline is irregular.

The climate of Sholapur is healthy, and, except the hot months, March, April,
 Climate and natural and May, is agreeable and free from extremes of heat or cold.
 features. The hot season from March to June, especially during March and
 April, is marked by a dry scorching heat. The mean temperature during this period is
 86°; and the climate is oppressive, with strong hot winds and occasional dust-storms. In
 March the hot winds blow from the east, and in April and May from the west.

The soil of Sholapur is of three kinds—black, coarse gray, and reddish. Most of the
 black soil is stiff and clayey, though near the meeting of the Bhima and Sina in the
 Sholapur Sub-division it is particularly fine. The chief rivers are the Bhima, with its right
 bank feeders, the Nira and the Man, and its left bank feeder, the Sina, which receives the
 Bhogávati from the north.

There is no authentic record of plague in Sholapur District previous to 1896.*

Sholapur District has suffered from three epidemics, which occurred in three successive
 years. Sholapur Town has suffered from one, but a severe one.
 Sholapur District. Akalkot State, which is under the Collector of Sholapur, has also
 Population—750,689. been attacked, but has so far suffered slightly. The dates of dura-
 tion of these epidemics were—

1st Epidemic—17th December 1896 to 27th April 1897.

2nd Epidemic—21st September 1897 to 15th May 1898.

3rd Epidemic—19th July 1898 to 31st May 1899.

First Epidemic (December 1896—May 1897).—Plague began in the Sholapur District
 with an imported case on the 7th December 1896 in Sholapur Town. Another imported case
 was discovered the following day. A month later, on the 21st and 23rd of January 1897
 2 more imported cases occurred. The first of these was presumably the cause of 4 indigenous
 cases which occurred between the 24th January 1897 and the 1st February 1897, the starting
 point in all these cases being Bombay. The notes made by Mr. W. T. Morison, the Collector,
 on the cases are instructive :—

17th December 1896—A female passenger from Bombay was found, on arrival of the
 train at Sholapur, to be suffering from plague. She died on the
 way to the Segregation Hospital.

* *Bombay Gazetteer*, Vol. XX.

18th December 1896—A fatal case imported from Bombay was not reported till after death had occurred. (Pandharpur.)

21st January 1897—A Máng woman, who had been to Bombay to attend her son who died of plague, returned to Hotgi village. She was taken ill of plague on the 21st and died the same day.

23rd January 1897—A man with a ticket from Bombay to Sholápur was found in a semi-conscious state in the lavatory of a carriage at Hotgi Railway Station. He was brought to the Plague Hospital at Sholápur and died on the 25th idem.

24th January 1897 to 1st February 1897—Between these dates 3 inmates of the hut in which the last case had died, and another woman of the same caste living in an adjoining hut, were taken ill of plague and all died, the last death occurring on February 1st. These 4 were not exposed to any source of infection, except from case No. 4. The cases were not reported until February 1st. The remaining members of the families were segregated in their fields, and their huts and the sweepings round about were burned. No other case occurred in the village.

Two more imported cases occurred on the 4th February 1897 and then 6 indigenous cases, the infection this time coming from Poona. The Collector's notes on these cases are as follows :—

4th February 1897—A labourer died of plague at his native village of Ozare in Karmála Táluka shortly after his return from Bombay.

Do. —Two labourers died of plague at their native village, Kumbhej, in Karmála Táluka shortly after their return from Bombay.

5th February 1897—About February 1st a Marátha woman died of plague in Bárámati Táluka, Poona. Her brother, who lived in Sindewádi, Táluka Málsiras, an adjacent village, went to her funeral. He returned to his village and was well until the 5th idem, when the plague declared itself and he died on the 7th. The surviving members of his household were at once removed from the village to a field at a distance when the following cases occurred :—

14th February 1897—Brother of the above—died on 15th February 1897.

16th February 1897—Mother of the same do. 20th do.

23rd February 1897—Brother do. do. 25th do.

4th March 1897—Sister-in-law do. do. 5th March 1897.

8th March 1897—Brother do. do. 10th do.

11th February 1897—Besides these, a Rámosi woman who lived near was attacked on the 11th February. She was removed by her friends to the adjacent village of Dharampuri, where she died on the 13th.

The measures adopted were immediate segregation, not only of the victims, but of all those who had been in any sort of communication with them, the disinfection or destruction of any articles that might be supposed to be infected, and the evacuation, unroofing, and disinfection of all houses occupied by such persons. The measures were successful, for, although imported plague continued to be discovered up to the end of April,* there were no

more indigenous cases. So ended the first epidemic, if

* 29 cases—25 deaths in all.

epidemic it can be called; and Sholápur District was free from either imported or indigenous plague for 5 clear months, *i.e.*, from 27th April 1897 to about the end of September 1897.

The Second Epidemic began on the 21st September 1897, and up to the 8th of October 1897 there were 19 cases—13 deaths in Sholápur Town, and 2—2 in the District. Of these 6 cases—4 deaths were imported. The actual dates of these cases are not known: but they all occurred previous to the 8th of October.

The town now suffered from a severe epidemic ; the history of which is as follows :—

Attention was first attracted by excessive mortality in the middle of August, and

Sholápur Town.
Population—62,329.

Dr. W. R. Scroggie, the Civil Surgeon, made a special report on the causes of it ; but it could not be traced to plague. The

first case of plague was the wife of a railway fitter who came to Sholápur from Lonávla. The details were as follows :—

“On 29th ultimo (August) information was received from Lonávla that a railway fitter, in whose family there were plague cases, had left with his wife for Sholápur. Enquiries were made, and the woman was at once removed to the segregation camp on 30th ultimo. The Civil Surgeon now reports that she has got the plague. The husband returned to Lonávla at once.”

The Collector adds—

“This is the only plague case which has occurred so far, and, as it was segregated at once, I do not think there is danger of the disease spreading.”

The first indigenous cases occurred on the 21st September 1897 and subsequent days, and the Collector gives the following detailed notes on them :—

“The local centre of infection appears to be the compound occupied up to 30th ultimo by Mr. Thatcher, Superintendent of Police, Sholápur. Behind his bungalow there is a line of out-houses, including the kitchen, a room where grain was stored, and three rooms occupied by servants. In front of this line is a separate room where his orderly and police guard stayed. To the east are stables and the syce's room.

“Mr. Thatcher went to Poona on the 15th, and almost immediately after his servants began finding dead rats, chiefly in the kitchen and in the grain room. No information was given, and the rats were thrown away into the hedge behind adjoining the road. Four or five a day were found. About the 21st or 22nd his cook, who stayed in the kitchen, fell ill. He had been in his service for over a month. He died on the early morning of the 24th. On the 25th the orderly and police sowár were found to have fever. The orderly then gave information about the rats, and steps were at once taken to disinfect the bungalow and out-houses, and to segregate those likely to be infected. The dhobi who lived in one of the out-houses was found to be suffering from fever. The cook's brother, who came from Goa *via* Belgaum and Hotgi the day before his brother fell ill, was searched for, and was found unable to move in another compound. Late at night on the 25th a woman was found with high fever in the Mhárs' temple in the Sadar Bazár, and was brought to hospital. Her husband was the brother of Mr. Thatcher's syce, and the two stayed in the room near to the grain shed in Mr. Thatcher's compound. On the morning of the 26th one of the Police constables who stayed in the compound was admitted to hospital with fever. On the morning of the 28th the syce and his brother, who had been attending his wife in hospital, were down with the disease. On the afternoon of the same day a boy of eight or ten, the son of the woman who looked after the Mhárs' temple in the Sadar Bazár, was admitted with plague. His mother stayed in a hut close to the temple, and it is most likely that the boy performed some services for the syce's sister-in-law while she was sick there and assisted in her removal. About the same time Mr. Thatcher's mchteràni was found to have high fever, and was put in hospital. On the morning of the 29th a man who had been employed by the bungalow owner in Mr. Thatcher's compound was reported to have died of fever at Wádi, a small hamlet outside municipal limits. He had had fever for some five or six days before he died. He grew very ill on the 27th, and died on the 29th. On the 30th (morning) Mr. Thatcher's hamal died of plague in a house in the city. He was in Poona with Mr. Thatcher, and turned on the 27th. He had fever in Poona, but was able to be at work up to the evening before he died, though complaining that he did not feel well. In Poona Mr. Thatcher stayed at 11, Staveley Road with Mr. Henderson of the 2nd Grenadiers, in whose compound several cases of plague occurred. The hamal most probably got the infection there, and his death cannot be connected with the other cases that occurred here.

“The cases have all been diagnosed as plague by the Civil Surgeon

“The origin of the outbreak is doubtful, and the only suggestions that can be made are of little value

“Infected rats have been found in six other compounds round about, and the disease appears to affect squirrels also, as several dead ones have been found in adjoining compounds. Four were also found in the Subordinate Judge's court, which is about two miles away. But so far no case has occurred among human beings, that is not directly traceable to Mr. Thatcher's compound.”

The infection, therefore, lay chiefly in and around Mr. Thatcher's bungalow, although it is difficult to say how it got there. But Modikhána and the Sadar Bazár were also touched; and it soon became evident that these two places were a serious menace to the town and neighbouring villages. The Collector then resolved upon a determined effort first to confine it to them, and then to eradicate it from them also, and details the measures adopted :—

“ Houses where plague cases are found are disinfected at once. The roofs have been in most cases removed, and, if they are of thatch, burned. The surrounding houses are emptied and sprayed with perchloride and the occupants allowed to re-occupy them when the floor and walls are dry. Two rows of houses where cases had persistently occurred were burned. Where dead rats are found, the place is disinfected at once.

“ The accommodation at the plague hospital and segregation camp has been and is being extended. The sect and caste hospitals will soon be ready. They have been put up near the municipal plague hospital, and will be under the supervision of the officer in charge of the flying column who arrived to-day.

“ A cordon of Police has been placed round the Sadar Bazár and Modikhána . . .

“ Arrangements for house-to-house visitation in the Modikhána and Sadar Bazár have been made and come into operation to-day. The leading inhabitants have volunteered for the work. They have been allotted different sections of the town and are giving every assistance. For *Pardah* and high-caste women, two ladies have been employed.

“ Deaths are required to be registered at one of the four hospitals and dispensaries (including the Dufferin Hospital in the case of *Pardah* women). The Medical Officer in charge, on receipt of intimation of the death, proceeds to the house of the deceased to ascertain, by inspection of the corpse and other inquiries, the cause of death. In only 5 cases was no intimation of death given.

“ The Patels of the surrounding villages have been directed to prevent any one coming from Sholápur without a pass from staying for even one night in their villages.”

Evacuation is conspicuous by its absence, and the results were disastrous.

Although the conditions in the camp were not favourable to plague, it was otherwise in the Sadar Bazár, where the bulk of the population, poor and dirty, were herded together in far from sanitary surroundings within low dark hovels of mud and thatch. Such a locality, once infected, soon became a hot-bed of the germ which spread rapidly. New cases occurred daily, and the people, realising their danger, became panic-stricken. An exodus took place, which lasted throughout October and November 1897 and resulted in the flight of some 25,000 people—about two-fifths of the population.

The measures themselves were unhappily not attended by any appreciable success. The cordon, easily evaded, was powerless to prevent large numbers of people leaving the Sadar Bazár daily: and house-to-house visitation, distasteful to the people, and carried out chiefly by unofficial persons in a time of panic, was necessarily perfunctory.

Meanwhile the disease slowly invaded the town, and by the end of October 1897 was firmly established there, the whole municipal limit being declared an infected area, and booking prohibited at Sholápur and at all stations within 20 miles on either side—Mohol, Pakni, Hotgi, and Silati—except on production of a pass signed by a Plague Authority

The numbers for October 1897 were—

IMPORTED.		INDIGENOUS.		TOTAL.	
Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
17	12	223	168	240	180

It was now (about 27th October 1897) that the first important change in dealing with the epidemic was made by an appeal to evacuation. The Sadar Bazár, Modikhána, Mángwáda and Mochiwáda were emptied of their poorer inhabitants, who were removed to a camp on the Bijápúr Road near the Motibág Tank. They were supplied with bambcos and matting, and built their own huts. "The disease now rapidly decreased," writes the Collector, "amongst the people so removed from their infected surroundings, but continued to rage with unabated severity amongst the better classes who had remained behind in their houses."

Major A. V. Anderson, I. M. S., arrived about this time, and by his advice it was decided to vacate the Modikhána and Sadar Bazár completely. This decision was announced by beat of drum, and by the 12th November 1897 the measure had been carried out. Most of the inhabitants went into fields and gardens round the city, but those who had no connection with land—butchers, bakers, tailors, etc.—went into the Motibág Camp and remained there for the next six months. Another large health camp for mill-workers was started on a large open plain near the Fort.

This latter work was done by Mr. Virchand Dipchand, C.I.E., at his own expense, for his mill-employés, who gladly left their houses to live in the comfortable sheds built for them. Mr. Virchand Dipchand also added a special hospital and segregation shed to the camp. A special doctor was attached to this hospital.

With the complete evacuation of Modikhána and the Sadar Bazár the first stage of the Sholápur epidemic may be said to end.

The interest now shifts to the town, which in its turn was to undergo the same ordeal : a long ineffectual struggle with the rising epidemic, accompanied with difficulties, various in kind, great in degree : and ultimate success almost wholly due to the complete, if tardy, evacuation of the whole city.

About the middle of November the number of cases in the town had become so large that it was clear that the existing organisation could not cope with the task, and the Collector accordingly asked for help.

The first to arrive was Captain B. H. F. Leumann, I. M. S. (between the 17th October and 3rd November), who headed a sort of flying column carrying medicines, disinfectants, etc., with it ; and throughout November the arrivals of persons on plague duty, with their work, were as follows :—

On 3rd November 1897 Mr. F. G. Pratt, I. C. S., was placed on special plague duty.

12th—Captain B. H. F. Leumann—appointed Plague Medical Officer, Sholápur Town.

13th—Lieutenant W. St. A. Wake, Middlesex Regiment—to No. 6 Ward (Sadar Bazár, Camp, Modikhána and Motibág).

15th—Lieutenant M. E. L. Bruce, I. S. C.—to No. 3 Ward.

18th—Lieutenant K. Henderson, 2nd Bombay Grenadiers—to charge of disinfection of passengers at Sholápur Station. Relieved of this by Captain Battiscombe on 29th and posted to No. 4 Ward.

29th—Lieutenant Cumming, Durham Light Infantry—to No. 7 ward ; and Lieutenant Kidd to No. 3 Ward.

Besides these, all the masters from the Municipal and High Schools, which were closed, as well as subordinates from all Departments throughout the district, were called into the town and enrolled for plague duty ; and by the middle of November, the ward system was in effective working order,

The wards were distributed originally as follows:—

- | | | | | |
|---------------------------|-----|-----|-----|--|
| 1. Town wards ... | ... | ... | ... | 1. Mr. Weir, I.C.S. |
| | | | | 2. Mr. Pratt, I.C.S. |
| | | | | 3. Mr. Kennedy. |
| | | | | 4. Lieutenant Bruce, I.S.C. |
| 2. Wards outside the Town | ... | ... | ... | 5. Mr. Thatcher, District Superintendent of Police |
| | | | | 6. Lieutenant Wake. |

Mr. Thatcher was put in charge of the small railway village Tiregaon and of the bungalow and servants' quarters near the station. Lieutenant Wake took over the Motibág Camp and the now empty Sadar Bazár and Modikhána. On the arrival of Lieutenants Kidd, Henderson and Cumming the number of wards was increased to 9, 7 being in the town. Towards the end of November, 30 men of the Durham Light Infantry also arrived for plague duty. They assisted the Ward Superintendents in searching, and Lieutenant Wake in the systematic disinfection of the town. From the end of November, too, the operations in the town consisted chiefly of the ward system and compulsory evacuation of badly-infected quarters. On the 12th December, Captain F. H. Dominichetti, 28th Madras Infantry, arrived and took over charge of Mr. Pratt's ward, the latter taking over the superintendence of the Health Camp. During the week ending 26th November 1897 Mr. A. Wingate, the Plague Commissioner, visited Sholápur and inspected the arrangements.

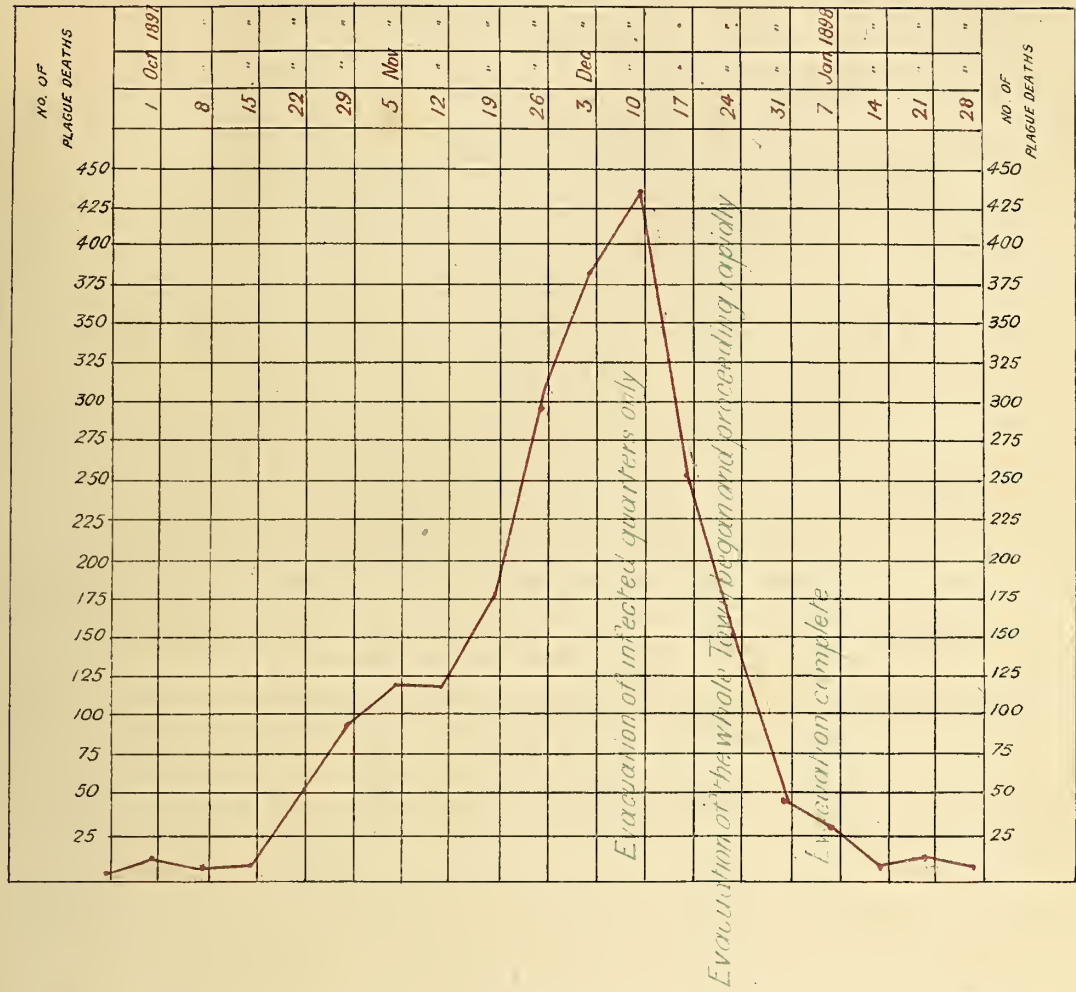
The epidemic reached its climax during the fortnight ending 10th December 1897, during which time 813 deaths were registered from plague; the maximum for one day being 98 deaths. The Collector's remarks on this period are striking:—

"These figures, terrible as they are in themselves, fail to convey an adequate idea of the appalling severity of the epidemic, unless it is remembered that the population had been reduced by flight by at least one-half of its normal numbers. After the 10th of December, the plague rapidly declined, chiefly owing to the fact that the evacuation of the city was more and more vigorously pushed on throughout December, until by the end of the month the city had been completely emptied and the whole population were camped out either in their own fields and gardens in the environs or the city or were lodged in the large organised health camps into which the poorer classes were drafted from their homes in the city. The largest of these health camps was on the open plain near the Fort and contained nearly 10,000 people. Being built almost entirely of gunny bags stretched over bamboos, it was named by Mr. Morison 'Pothepur' or 'Gunny Bag Town.'"

Evacuation may then be taken as begun on 3rd December 1897 and complete from 31st December 1897. The following figures bear eloquent testimony to its efficacy:—

Week ending							INDIGENOUS PLAGUE.		REMARKS.
							Cases.	Deaths.	
5th November 1897	146	117	} No evacuation.
12th "	"	...	...	...	...	...	143	118
19th "	"	...	...	...	...	...	221	182
26th "	"	...	...	...	...	...	363	297
3rd December	"	502	377	} Evacuation of infected quarters only.
10th "	"	...	...	...	...	...	501	436
17th "	"	300	246	} Evacuation of the whole town begun and proceeding rapidly.
24th "	"	...	...	...	...	...	134	49
31st "	"	...	...	...	...	...	53	36
7th January 1898	26	27	} Evacuation complete.
14th "	"	...	...	...	...	...	9	9
21st "	"	...	...	...	...	...	7	11
28th "	"	...	...	...	...	...	5	8

SHOLAPUR TOWN
Population 62,329



Month.						Cases.	Deaths.	REMARKS.
October	1897	—4	weeks	...	...	211	156	} Before evacuation.
November	"	—4	"	...	...	873	714	
December	"	—5	"	...	...	1,490	1,244	
January	1898	—4	"	...	...	47	55	} After evacuation.
February	"	—4	"	...	...	18	18	
Total						2,639	2,187	

The mortality for the 4 weeks preceding, and that of the 4 weeks succeeding, evacuation, *i.e.*, November 1897 with January 1898, may here be compared:—

Mortality for 4 weeks preceding	...	...	...	...	714
Do. do. succeeding	...	...	...	...	55

With the evacuation of Sholapur Town the second stage of the epidemic may be said to end.

Of the third stage, there is little to say. The figures record the rapid subsidence of the disease, and in the period of a few weeks its total cessation: for, imported cases excepted, Sholapur Town was practically free from plague from the beginning of February 1898.

A remarkable feature of this epidemic was the health of the people in the Camps, which was very good. The Collector writes (2nd January 1898):—

“Pothepur Camp with 10,000 inhabitants, which is not 100 yards from the town walls, has not had a single case for three days now, and is a most striking example of the efficiency of the evacuation cure.”

The District in the meantime had been, with one or two isolated exceptions, quite free from indigenous plague, though much troubled by imported cases from Sholápur, and it was not till about the middle of December that indigenous plague can really be said to have begun: but, even then, owing to strenuous efforts in carrying out evacuation, disinfection, segregation and cognate measures, it never reached alarming figures. During the week ending 7th January 1898 the cases in the district fell from 95 to 53, but they soon rose again; and it was but one more phenomenon in the course of a disease enveloped in obscure phenomena.

As the town grew more and more empty, and the fields and gardens round it inhabited, the increased danger of spread to the villages in the district was foreseen, and efforts were directed towards saving them. Orders were early issued that fugitives from Sholápur Town were not to be permitted even for one night in any village, and on the 22nd October Mr. G. K. Agarkar was called in from Famine Duty and appointed Travelling Plague Authority. His duty was to tour round villages within a radius of 20 miles and deal with such plague as might occur in any village; and also to see that the village authorities obeyed the plague orders already issued. Unhappily, amongst the first victims was Mr. Agarkar himself, who contracted the disease in one of the villages in his charge. No one could be spared to replace him in the face of the crescent epidemic in the town, and the villages were consequently for some time left without regular supervision.

In order to further prevent spread, at the end of November a cordon of Police posts was drawn round Sholápur Town itself, and carts were prohibited from leaving the Municipality at night under any circumstances. Nevertheless, on the 17th December 1897 indigenous plague appeared in the villages of Shelgi and Nandur, about 1 and 8 miles from Sholápur respectively. These villages were at once evacuated and every house in each disinfected with perchloride of mercury. On the 31st December four more villages reported indigenous plague, amongst them Kurul. The infection of the latter, a large market village, was a cause of anxiety: and indeed the infection of 4 villages subsequently attacked was traceable to it.

On the 5th January 1898 Mr. W. T. Morison, the Collector, was transferred from the District, Mr. J. W. A. Weir succeeding him. Lieutenant Bruce and Kidd were about the same time relieved of their duties in the town and appointed Inspecting Plague Officers in the District, touring round the villages, directing, and, where possible, superintending plague operations where the latter were necessary. It was soon evident that the mischief in the villages was wider-spread than had been supposed; and it was discovered that indigenous plague had existed and had been successfully concealed from the middle of November.

The Collector thus describes the efforts to cope with the spread and subdue the disease where found:—

“But with increased supervision, concealment was no longer possible: and by the end of the first fortnight in January, reliable information had been obtained as to the actual

condition of the villages. The villages found infected were immediately evacuated; by the end of the 3rd week in January, 19 villages had been evacuated. Nevertheless the plague continued to spread, and fresh villages were attacked every week. It became evident that closer supervision by superior officers was required, and that it was necessary to re-organise the system for dealing with the plague in the villages. The section system was therefore introduced in the first week in February.

“The new system worked well, and its results soon showed themselves in a decline in the number of cases in the Táluka, which, with a few fluctuations, continued steadily until the final disappearance of the plague from the district at the beginning of April.

“The following table shows the indigenous cases which occurred in the villages, week by week, from the beginning of February:—

Week ending					INDIGENOUS.	
					Case	Deaths.
4th	February	1898	...	...	162	141
11th	„	„	...	...	104	106
18th	„	„	...	...	81	53
25th	„	„	...	...	101	78
4th	March	„	...	...	56	47
11th	„	„	...	...	40	33
18th	„	„	...	...	16	15
25th	„	„	...	...	6	5
1st	April	„	...	...	11	7
8th	„	„	...	...	22	6
15th	„	„	...	...	1	...
22nd	„	„	...	...	...	1
29th	„	„	...	...	...	...
					600	492

“The total number of villages attacked in the District was 46.”

In the fact that each village, as it was found infected, was at once evacuated, is without doubt to be sought the reason of the mild figures of the epidemic in the district when compared with those of the town. With the dying out of the epidemic in the town towards the middle of February the question of permitting the people to return to their houses had to be considered, and the decisions arrived at are thus enunciated by the Collector:—

“After the disinfection of the city had been completed, and as the numbers of plague cases in the surrounding villages decreased, the re-occupation of houses in the city was commenced at first slowly and tentatively; but afterwards, when it was found that no recrudescence followed on the re-occupation even of houses which were notorious plague haunts, permits to re-occupy houses were given in increasing numbers. In no case, however, was such permission given except to residents of the health camps and settlements who had been continuously under inspection for at least 10 days. Permission was at first made conditional on the making of sanitary improvements, wherever necessary, in the way of better light and ventilation. Overcrowded and insanitary houses were not allowed to be re-occupied. Nearly all the houses in the Sadar Bazár were thus improved. Much valuable assistance was given in the supervision of this work in the Sadar Bazár and Modikhána by Khán Sáheb Sanjána, the Subordinate Judge, and by a local Pleader, Mr. S. C. Dávar.”

Sholápur Town is a good example of the striking efficacy of evacuation even when resorted to after the disease has become firmly rooted; and the district demonstrates the possibility of greatly mitigating an epidemic by keen observation and vigorous action *ab initio*. The spread in the district is shown by the following table, the date and origin being given where known:—

Town or Village.	Táluka.	Date of first indigenous case.	Source of infection where known.
Sholápur	Sholápur	1st October 1897 ...	Bombay.
Shelgi		17th December 1897 ...	Poona.
Nandur		Do. ...	Sholápur.
Walsang		31st December 1897 ...	Do.
Dhotri		Do. ...	Do.
Sholápur suburbs	Mádha	Do. ...	Do.
Kurul		Do. ...	Do.
Sayad Warwad... ..		Do. ...	Do.
Bhogaon	Sholápur	7th January 1898
Tirhe	Sholápur	14th January 1898 ...	Unknown.
Kamthi Khurd		Do. ...	
Koroli		Do. ...	
Kumbhari		21st January 1898 ...	
Doddi		Do. ...	
Mulegaon		Do. ...	
Boránni... ..		Do. ...	
Pakni		Do. ...	
Sawat Khed		Do. ...	
Hotgi		Do. ...	
Mardi		Do. ...	
Belati		Do. ...	
Kavate		Do. ...	
Kumte		Do. ...	
Dahitne		28th January 1898 ...	
Haglur	Pandharpur... ..	Do. ...	
Hipparge		Do. ...	
Ulhe		Do. ...	
Soregaon		Do. ...	
Kandalgaon		Do. ...	
Sangdhari		Do. ...	
Shingadgaon		Do. ...	
Dongaon		Do. ...	
Sarkoli		Do. ...	
Bale		4th February 1898 ...	
Dahitul	Sholápur	Do. ...	Unknown.
Degaon		Do. ...	
Shetgi		Do. ...	
Kásegaon		Do. ...	
Madra		Do. ...	
Honmurgi		11th February 1898 ...	
Honsal		Do. ...	
Kámti Budruk		Do. ...	
Musti		Do. ...	
Vángi		18th February 1898 ...	
Boral	Sholápur	Do. ...	
Ahervádi		25th February 1898 ...	

The Third Epidemic began towards the middle of July 1898, and the total number of cases and deaths up to the 12th of August was as follows:—

Village.	Táluka.	INDIGENOUS.	
		Cases.	Deaths.
Kondi	Sholápur	10	2
Akole		25	8
Katewadi	Mádha	33	32
Pokhrapur		107	78
Total ...		175	120

All the cases were indigenous, and if any imported cases occurred, they were not discovered. But the case of Katewádi village is noteworthy; and the Collector's remarks are most interesting :—

“On the 19th of July rumours reached Sholápur of suspicious sickness and deaths in the village of Katewádi in the Mádha Táluka. This village was not one of the villages which were known to be infected with plague during the previous epidemic; but it lies in close proximity to three villages, Kurul, Sayadwarwad, and Gotewádi, which suffered severely during the last epidemic. I reached the village on the 20th July, and found that 7 deaths from plague had taken place in the village before my arrival, and that 8 persons were lying sick with plague in different houses in the village. The village was a small one, of not more than 250 inhabitants, and I induced the people to evacuate the village and sleep outside in temporary huts on the same day on which I arrived. The patients were allowed at first to remain in their houses, but were afterwards gradually taken out into the fields, when the people had had time to settle down outside. A census was taken of all the inhabitants, and steps were taken to trace out and keep under observation such persons as had recently migrated to other villages.

“The history of the plague in this village was interesting and suggestive. Examination of the Death Register and enquiries made on the spot among the villagers made it clear that 3 deaths from plague had occurred in the village towards the end of the month of May, but they had not been recognised and reported as plague deaths. Two of them occurred in one house, and the description of the symptoms and the circumstances of the deaths left no doubt that they were due to plague, but as the fact remained unknown to the authorities nothing was done to destroy the infection in the houses or in the village, and the villagers remained in occupation of the village. The disease remained quiescent in the village for two months and then broke out again. Among the first persons attacked were some who were closely connected with the persons who had died in May, and who died in adjacent houses.

“There seemed to be every reason to suppose that after the 3 deaths in May the disease germs remained dormant owing to the unfavourable conditions of hot weather and consequent desiccation of the soil, but that with the advent of the rains and the accompanying coolness and dampness they sprang into renewed activity.”

Suspicious deaths occurred on the 24th July in Pokhrápúr, and some 15 deaths had occurred when the Collector went in person to examine matters. He says :—

“Plague has been in this village from about the beginning of July. I could get no clue to its origin.”

Equally obscure was its origin in Kondi and Akole.

The infection again spread from village to village, and the district has suffered continuously since. Evacuation no sooner frees one village than another is attacked. This will be seen from the following table :—

Date of infection.	Village.	Táluka.	Source.
19th July 1898	Katewádi	Mádha	Probably Kurul.
24th „ „	Pokhrápúr	„	Unknown.
„ „ „	Kondi	Sholápur	„
Between 24th July and 12th August 1898.	{ Akole	„	„
	{ Shamsápur	„	Akole.
26th August 1898	Mohol Ry. Station	Mádha	} Unknown.
16th September „	Mohol	„	
21st October „	Kardeshalli	Sholápur	
„ „ „	Vairag	Bársi	
„ „ „	Chikli	„	
4th November „	Ghatne	Mádha	
18th „ „	Yáwvali	„	
„ „ „	Dahitne	Bársi	
9th December „	Hingni	Mádha	
„ „ „	Kolegaon	„	}
„ „ „	Tambole	„	
16th „ „	Malik Peth	„	

The source of infection in Shamsápur was clearly traced, for the Collector writes :—

“ In the case of the village of Shamsápur, the origin of the infection has been clearly traced. A woman from Akole came into this village about the 10th of August. She was a kinswoman of the Pátíl, who allowed her into the village contrary to orders, instead of detaining her outside under observation. She died of plague and infected the Pátíl's family and the whole circle of his relations who all live in adjacent houses. The rest of the population have remained free. Shamsápur is only a small hamlet of 12 houses, and it is not expected that the plague here will do much mischief. The village has been évacuated.”

Comparing this table with that for the last epidemic, it will be seen that, with the exception of Dahitue, *all the villages attacked now suffered for the first time.*

The figures up to 31st December 1898 by months from August 1898 are—

Months.			Cases.	Deaths.
July and August 1898—7 weeks	...		271	193
September „ —5 „	...		137	116
October „ —4 „	...		199	142
November „ —4 „	...		85	68
December „ —5 „	...		186	152
Total			878	671

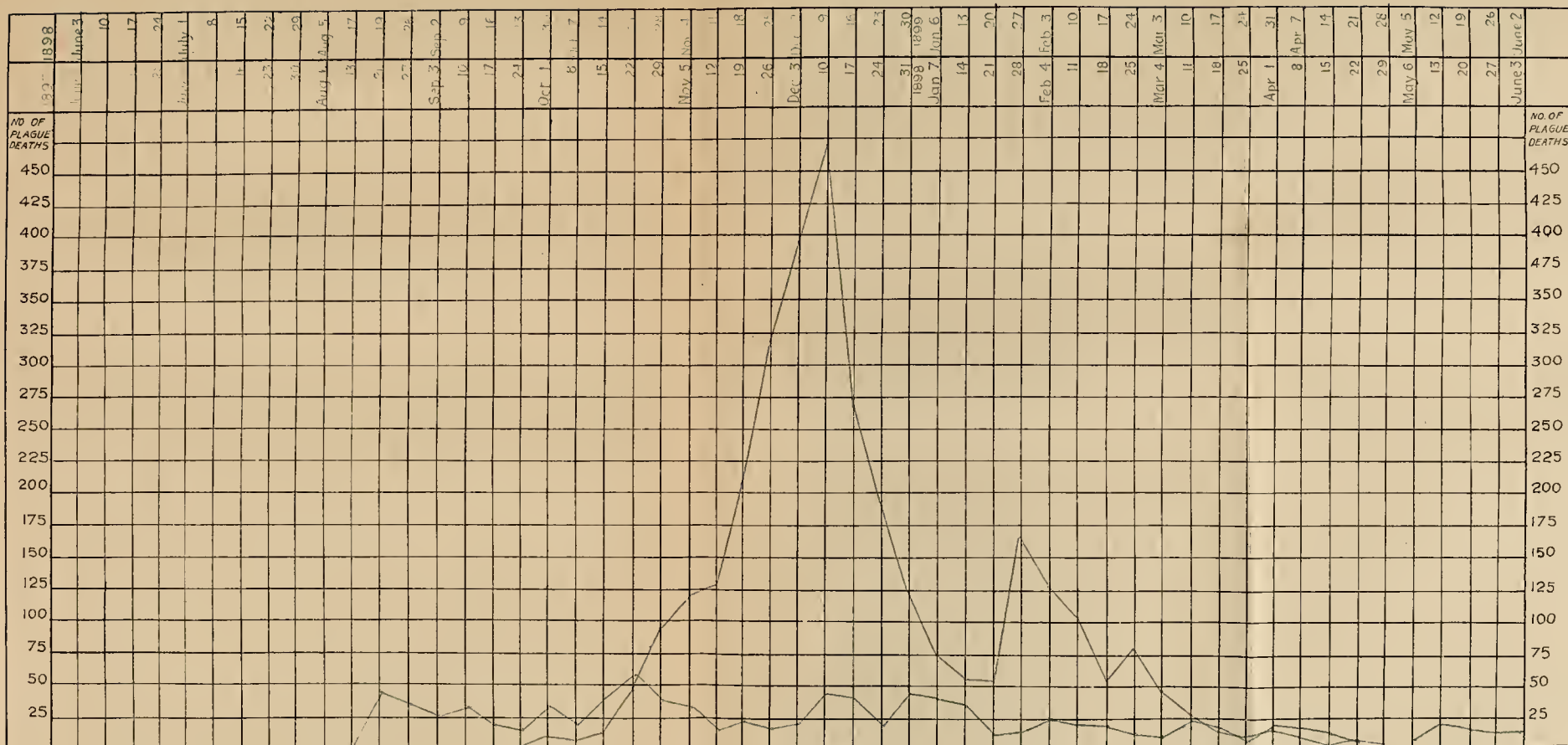
Towards the end of December 1898 there was a steady subsidence, and plague has not been bad in the district since, though the weekly figures show considerable fluctuation, owing to the sudden infection of fresh villages. In the second half of April 1899 the district was quite free, but two villages in the Sholápur Táluka were re-infected in May. The attacks, however, have been mild, and in the week ending 2nd June only one of them, Wángi, returned three cases. Evacuation was always promptly resorted to, and no place remained infected for any length of time. The returns for the year 1899 are as follows :—

Month.				Cases.	Deaths.
January	...	...	...	100	86
February	...	...	...	83	67
March	...	...	...	59	45
April	...	...	...	14	16
May	...	...	..	25	24
Total				281	238

A Chart showing weekly Plague mortality in Sholapur District is given opposite.

SHOLAPUR DISTRICT.

Chart showing Plague Mortality.





CHAPTER IX.

THE SOUTHERN DIVISION.

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BELGAUM DISTRICT.

Area	4,652 sq. miles.
Population in 1891	1,013,261.
Density of population	217.81 per sq. mile.
Rainfall	...	...	...	...	30 inches.

Belgaum is bounded on the north by the Miraj and Jath States ; on the east by the States of Jamkhandi and Mudhol ; on the south-east by Dhárwár ; on the south by North Kánara ; and on the west by Sávantvádi and Kolhápur.

Climate and natural features.

Belgaum, running parallel to the Sāhyádri hills, with a very irregular out-line, measures about a hundred miles from north to south and fifty to eighty miles from east to west.

The pleasantest climate in the District is in a tract parallel with the crest of the Sāhyádris, between the western forests and the treeless east. The Belgaum year may be arranged into three seasons, the cold and dry season from the middle of October till the middle of February ; the hot and dry season from the middle of February till the beginning of June ; and the wet season from the beginning of June till the middle of October. About the middle of October the cold weather perceptibly sets in, the evening air begins to be chilly, heavy fogs gather soon after sunset, and towards the morning and for some time after sunrise the country is shrouded in thick mist. Towards the end of December or early in January the night temperature is at its minimum. The hot season sets in about the middle of February, and the temperature rises rapidly until it reaches 100° in May. Geologically the soils of the District may be divided into two classes, the red and the black. The red soils are primary soils, that is, they are the direct result of the decomposition of the iron-bearing rocks. The black soils are secondary soils, that is, they are rock ruins charged by the addition of organic matter.

Previous epidemics. There is no authentic record of plague in the Belgaum District previous to 1897.*

The Belgaum District enjoyed immunity both from imported as well as indigenous plague till October 1897. But this immunity could not be expected to continue much longer, when it is remembered that it was surrounded on the north-east, west and north-west by the Sholápur District, the Kolhápur Agency and the Sátára District, respectively, places where severe plague epidemics were then raging. As the reports for 1897-98 received from this District consisted merely of isolated reports on villages, and no report has yet been received for 1898-99, the progress of plague cannot be sketched in any detail. But the course of the disease in these villages has been sketched at some length, as the measures taken in them were presumably similar with those taken elsewhere in the Belgaum District.

First Epidemic (November 1897—June 1898).—The first case occurred on the 21st October 1897 in Kágvád village, the source of infection being probably due to importation from Sátára. The following particulars are taken from the District Deputy Collector, Mr. N. C. Soman's report :—

* *Bombay Gazetteer*, Vol. XXI.

“Ten persons of the Gujar caste left Tásgaon in the Sátára District on 27th September 1897 when plague became severe there, and arrived at Kágvád the same day, getting down at the Shedbal Railway Station, which is three miles from Kágvád. It was not then suspected that any one of them was infected. They put up with their relative Bhauchand, whose house is situated behind the market street and almost in the centre of the village. It appears one woman of that party got sick and the whole party left Kágvád on the 1st October 1897, as they could not remain longer there without detection.

“About the 21st October 1897 one Bala, wife of Satiapa Karav, who lived in a house in Bhauchand’s back-yard (east), got fever and she died on the 26th. About this time a boy named Satapa, aged 12, who lived in a house adjoining Bala’s and who was a relative of Bala, was attacked with fever and he died on the 30th. Radhabai, widow of Rama Simpi, living in a house adjoining Satapa’s, was attacked along with Satapa and also died on the 30th. She visited Bala during her illness. Bhauchand, with whom the Tásgaon people put up, had fever about the 27th and died on 1st November. One Devendra Kasar, who lived opposite (west) to Bhauchand, in a house separated only by a road about 12 feet in width, had also an attack simultaneously with Bhauchand, and he died on the 31st October. Krishnabai Pudale, who lived in a house adjoining Bhauchand’s to the south, was attacked and died on 2nd November 1897. Amina Kone Usman, living behind Devendra’s house, was next attacked and died on 6th November. Raghu Satar, who lived in a house adjoining Bhauchand’s to the north, was also attacked and died on the 7th. Bala’s daughter-in-law, Tipaca, who lived with her, and Bala’s sister Satyava, who visited Bala during her illness, and Bhagirathi, daughter-in-law of Radhabai, who lived with her, all died on the 7th November 1897, after a very short illness.

“From the above it is clear that plague was imported into Kágvád by the Tásgaon Gujars, and that Bhauchand Gujar’s house was the centre from which it spread in all directions.”

The following measures were adopted to combat and deal with the outbreak:—

- (1) Sanitation and cleaning up of the village.
- (2) Muster and examination of the residents of the village.
- (3) Evacuation of houses and streets.
- (4) Muster and examination of the inmates of huts in fields.
- (5) Removal of the sick to hospital.
- (6) Segregation of contacts.
- (7) Interdiction of communication.
- (8) Disinfection.

The total number of cases and deaths in Kágvád, from November 1897 to March 1898, was 220—181, respectively.

Up to the 12th of November 1897, 21 cases—18 deaths were reported throughout the District, of which three cases and two deaths occurred in Belgaum Town.

Between October 1897 and June 1899, Belgaum District and Town each suffered from two epidemics. The first epidemic lasted from November 1897 to June 1898 in the District, and from December 1897 to April 1898 in the Town. Neither of these epidemics was very severe. The second, from June 1898 to April 1899, was very severe in the District, and from the middle of July 1898 to January 1899 was severe in the Town. Since first infection in October 1897, the District has never been free for a single week.

The following statement compares the figures for Belgaum Town with the rest of the District :—

Week ending	BELGAUM TOWN.		OTHER PLACES.	
	Cases.	Deaths.	Cases.	Deaths.
3rd December 1897 ...	10	10	90	75
10th " " " ...	9	7	49	50
17th " " " ...	13	9	62	44
24th " " " ...	31	25	36	38
31st " " " ...	36	35	47	42
7th January 1898 ..	56	60	37	31
14th " " " ...	69	54	45	39
21st " " " ...	52	47	25	22
28th " " " ..	38	28	43	43
4th February " ..	26	26	23	14
11th " " " ...	10	8	59	56
18th " " " ...	11	6	56	43
25th " " " ...	9	11	75	67
Total ...	370	326	647	564

Jugál village was infected from Kágvád by a woman who returned sick after visiting a plague-stricken relation. She died on the 21st November 1897, within two days after her return. The village officers state that they did not know that she had been to Kágvád or that it was a case of plague. The total number of cases and deaths for this epidemic was 121—106, respectively. All the measures of suppression and control adopted at Kágvád were adopted at Jugál also.

Jugál.
Population—2,589.

Of segregated people becoming re-infected after visiting their houses in the village, the Deputy Collector writes as follows :—

“At Jugál we did not wait for evacuation until the occurrence of a suspicious case in the street. The entire village was evacuated before the 16th January 1898.

“Up to this time 32 cases had occurred, 6 in the village site before discovery of plague, 9 in the segregation camp, 15 in the fields, and 2 in such part of the village site as had not been evacuated. The residents of an infected house and of adjoining houses were taken to the segregation camp, and the rest were permitted to go to their fields. From the 18th to 26th January 1898 there was no case. Five cases, however, occurred at once on the 27th, and they began to occur again almost every day until the 6th of February, when they stopped again for a few days. I have not been able to ascertain the cause with certainty, but I have strong suspicions that the fresh cases were due to the return to houses and the opening of grain pits during my illness, when on the 26th January 1898 I proceeded to Kudchi for medical advice.

“On the 10th of February, on account of the storm, which was even worse than at Kágvád, the people were allowed to return to their houses and live in verandahs. They were turned out as soon as the ground became dry and the huts habitable. But even the short sojourn of three or four days was disastrous. We had a severe recrudescence.”

The first indigenous plague cases in Khánápur, which were identified as such, occurred on the 10th January 1898. Five days previous to this a number of rats and mice had been found dead in a house, the floor of which was being dug out and relaid in preparation for a marriage ceremony. The inmates of this house had thereupon been ordered to quit the village. On the same day, an imported case of plague was discovered, the patient being

Khánápur.
Population—4,918.

a washerman who had come from Sháhápúr. He had previously undergone inoculation, but was suffering from fever on his arrival. Again, on the same day, a case was discovered in a house immediately adjoining that in which dead rats had been discovered. This was the first indigenous case. On the 16th December 1897 an imported case had been discovered. It is to be noted that neither of these two imported cases became centres of infection. They occurred in houses far away from the one in which dead rats were found, and it was not till well on in the epidemic that people living in houses near them were attacked. From the house in which the rats died the disease spread slowly but steadily, proceeding for the most part in a northerly direction, but sending off off-shoots to the west and south-west.

At first partial evacuation was tried, but it did not stay the progress of the disease. Complete evacuation was, therefore, resolved upon, and on the 17th of February all the inhabitants were in the fields. Re-occupation took place on the 22nd April. After re-occupation, 6 cases, 4 of which ended fatally, occurred, and 2 occurred, both fatal, among the inhabitants of the huts in the fields who had not returned with the others. The total number of cases, inclusive of those occurring after re-occupation, was 59 and of deaths 56. The percentage of deaths to attacks was, therefore, 95·76.

Plague was imported into Halsi by direct human importation from Khánápúr : the first case being that of a Khánápúr man attacked on the 11th and who died the same day. There was another case on the 12th, but the disease did not re-appear again till the 2nd February, when two cases occurred. It was not, however, till the 8th that plague was actually discovered. When once the disease established itself, it spread rapidly; and during the nine days between the 7th and 15th February, 20 cases—19 deaths were reported. The disease was then almost wholly confined to the Sonár caste, to which the original importers belonged: and the persons attacked were all living in one quarter of the village.

Halsi.

Population—2,545.

Half the village was evacuated on the 20th February, the infected streets having been previously cleared, and the other half on the 1st March. The effect of evacuation was to stop the disease at once, and there were no cases between the 25th February and the 20th March. The case which occurred on the latter date was due to infection from Nándgad, the person attacked having gone to that village and stayed with an infected family there. Meanwhile, the infected houses, together with the adjoining ones, had been thoroughly disinfected, cleaned and opened; while the remaining houses in the village had been opened up and cleaned by the villagers themselves. This they had done in a very thorough manner, and there was not a single house in the village which had not been thoroughly opened to light and air for at least ten days before the 25th of March. On that date a heavy thunderstorm broke over the town, and the Resident Plague Authority took it upon himself to allow the people to re-occupy the village. Plague immediately re-appeared, and it is noteworthy that the house in which it appeared was situated quite close to the house last affected before evacuation. 63 cases—56 deaths were reported from this village from January to June 1898.

Second Epidemic (June 1898—April 1899).—From April to July 1898 there was scarcely any plague reported from Belgaum Town—35 cases and 26 deaths in all—and an average of about 40 cases a week from the District, and it was hoped that the disease would die out altogether. But this hope was not realized, for a steady rise in the mortality showed only too clearly that Belgaum was doomed to suffer another epidemic: an epidemic of greater severity and longer duration than the first.

No details can be given for this second epidemic, as no report has been received for the period June 1898—June 1899 for Belgaum District : but the following statement shows how, from July 1898, the figures rose steadily and rapidly, subsiding again in March 1899 in the District, and in December 1898 in the Town :—

Month.						DISTRICT.		BELGAUM.	
						Cases.	Deaths.	Cases.	Deaths.
June	1898	...	...	..	...	198	146	6	2
July	"	...	...	...	...	1,164	849	36	27
August	"	...	...	...	...	2,020	1,485	80	69
September	"	...	...	...	..	4,408	3,114	869	628
October	"	...	...	...	..	6,564	4,879	1,227	939
November	"	...	...	...	...	4,628	3,579	409	290
December	"	...	...	...	...	2,242	1,794	85	77
January	1899	...	...	...	...	786	614	16	12
February	"	...	...	...	...	837	675	15	15
March	"	...	...	...	..	538	428	23	18
Total						23,385	17,563	2,766	2,077

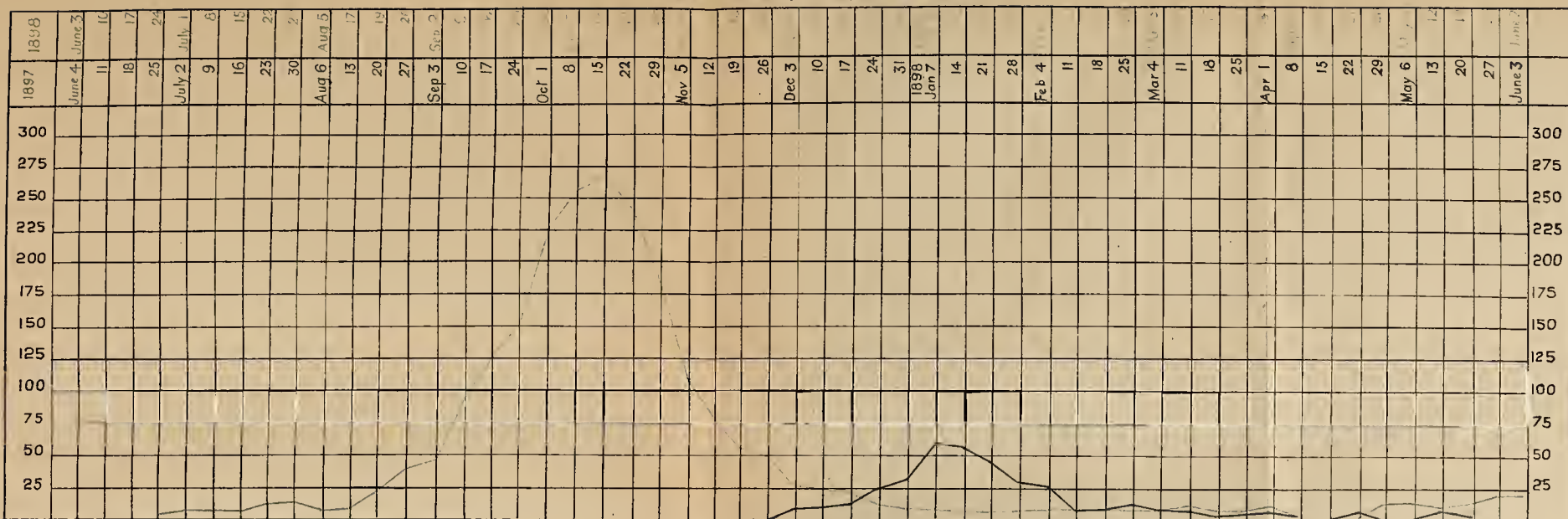
Since the 2nd of June 1899, this District has suffered from a third epidemic of plague, which, though not so severe as the one preceding it, carried off no less than 10,634 people in the period lapsing between June and November 1899. This epidemic, however, lies outside the scope of the present review, although for the sake of interest and completeness the figures are given below. Unlike the second, this epidemic gradually increased in virulence until it reached its highest point in the second week in October (953 cases—661 deaths), subsiding as gradually as it rose. The following are the monthly figures :—

Month.					Cases.	Deaths.
June	1899	...	...	...	714	459
July	"	..	...	...	1,930	1,370
August	"	...	...	...	2,773	2,211
September	"	...	..	...	3,843	2,697
October	"	...	..	...	3,485	2,448
November	"	...	...	...	1,935	1,449
Total					14,680	10,634

BELGAUM.

Population 27,952.

Chart showing Plague Mortality.

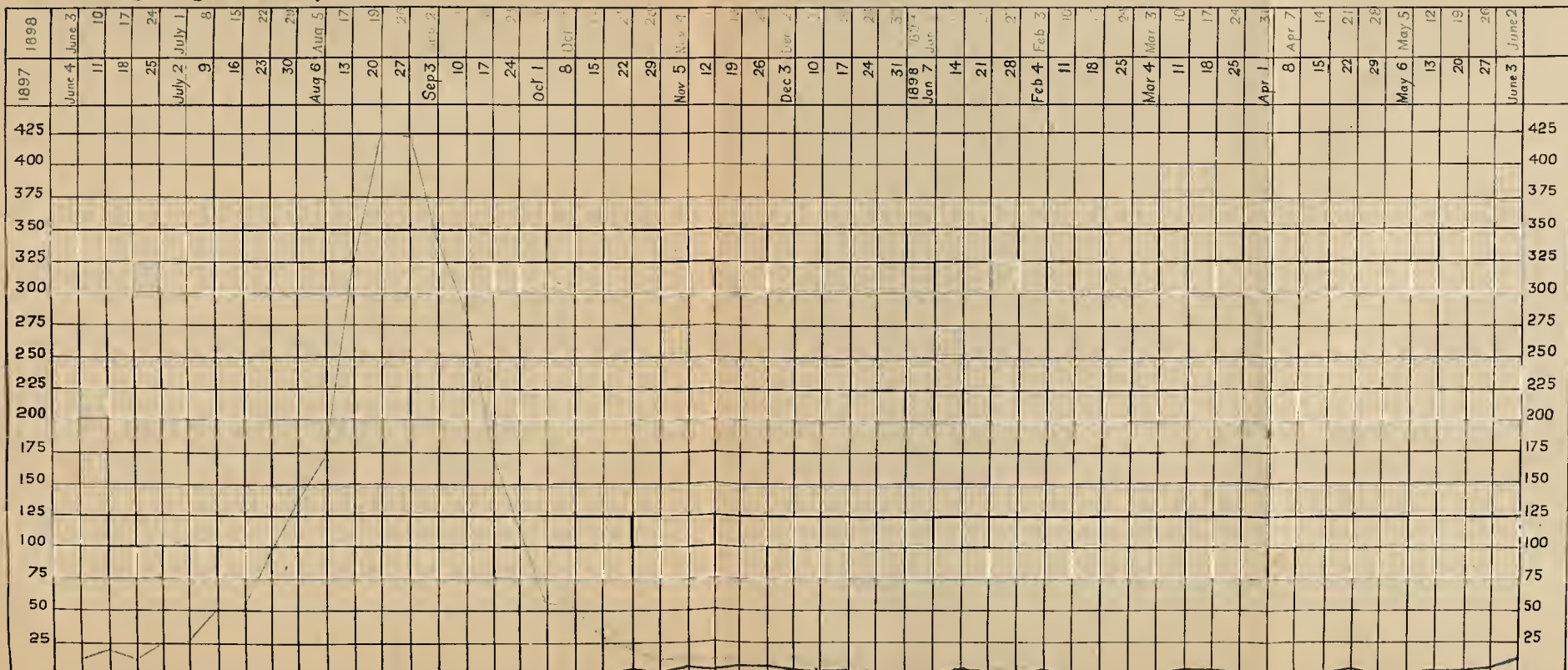


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HUBLI

Population 52,595.

Chart showing Plague Mortality.





BIJAPUR DISTRICT.

Area	...	...	...	...	...	5,668 sq. miles.
Population in 1891	...	...	...	...	...	796,339.
Density of population	...	...	...	...	...	140·42 per sq. mile.
Rain-fall	...	...	...	...	...	22 inches.

The Bijápur District—an irregular, egg-shaped belt of land,—110 miles long, and varying in breadth from 75 miles in the centre to 5 in the extreme north and 50 in the south—forms the most easterly portion of the Bombay Presidency. Its boundaries are roughly as follows :—North and north-east, Sholápur District and Akalkot State ; east and south-east, the Nizam's territory ; south-west, Lhárwár District and Rámdurg State ; west, Belgaum District and some minor States. The Bhima River separates it from Sholápur District on the north and north-east : and the Malprabha River on the south-west from Belgaum District.

The climate, except in Bádámi, which is overgrown with stunted bushy vegetation, and in Muddebihál, which is marshy, is dry and healthy. March and April are the hottest months of the year. The heat of May is relieved by clouds and occasional thunderstorms. The District is well watered, for, although the rainfall is small, rivers and streams abound. The soil of this District is of two kinds—black and red. The black soil, which is formed by the ruins of rock changed by organic matter, has great moisture-holding capacity, and in the rainy season becomes clayey and impassable : while in the hot weather it shrinks and gapes in deep fissures. This black soil is exceedingly fertile, and the Dar Valley, where it abounds, is proverbially known as the “Granary of Bijápur.” The red soil does not retain moisture and is unfruitful.

Bijápur District appears to have previously suffered from only one recorded epidemic of plague. This occurred in the year 1689. Aurungzebe himself was at Bijápur at the time, and the disease appears to have broken out first amongst his soldiers. 100,000 people are said to have perished in this outbreak ; and many more fled. When the disease had abated, Aurungzebe ordered a census : and it was found that 1,016,000 persons had melted away in the outbreak of plague and in the destruction of Sháhápur. Bijápur City never recovered itself, and from that time it decayed with a speed for which it is difficult to account. Aurungzebe, anxious that it should regain its former importance, made every effort to restore its prosperity. All, however, was in vain: life had left the City.*

Up to the beginning of December 1897 this District enjoyed a happy immunity from plague. From that time, however, up to the end of February 1898, imported cases, rarely absent from the history of any plague epidemic, occurred. But they were not—either at any particular time, or, in the aggregate, throughout the period of their occurrence—numerous. From the 3rd December 1897 to the 23rd February 1898 (the date of the first indigenous cases), the total number of these imported cases amounted to 3. These occurred between the 3rd and 20th December 1897, producing no ill results : and the slight epidemic which occurred in Kaládgi during February and March 1898 in all probability owed its origin to infection from the Sholápur District. No other village was infected, nor were there any more imported cases till the end of October in the same year.

* *Bombay Gazetteer*, Vol. XXII.

First Epidemic (February-March 1898).—Occasional attacks of fever unaccompanied by buboes occurred as far back as December 1897, and raised the total mortality of the village. But these were not considered in any way extraordinary or exceptional. On the 23rd February 1898 the first case of true plague was recognized, and by the 25th of that month 8 cases (5 fatal) had occurred.

The village was at once evacuated, and the infected houses disinfected with perchloride solution: these steps being taken under the superintendence of Mr. J. L. Lushington, Superintendent of Land Records and Agriculture. Only the portion known as the "Laskar" quarter of the village was infected, and, the village being vacated, the infection did not spread to any other quarter. Mr. J. L. Lushington comments as follows on this little outbreak :—

"As regards our one outbreak in Kaládgi, we learnt that evacuation of houses promptly was the best method of prevention: infection to those living in the fields did not extend beyond 10 days after evacuation; and in two cases people returning to sleep in their houses were infected by plague and died. The people were kept in their fields over two months, and no cases have occurred since re-occupations."

Indeed, from the 4th March 1898, the outbreak was over; the figures being—

Week ending				Cases.	Deaths.	REMARKS.
25th February 1898	8	5	Evacuation complete about 27th February.
4th March	"	...	...	12	11
11th "	"	...	...	1	1
18th "	"	...	...	1	...
25th "	"	...	...	1	1
1st April	"	1	...	

In the rest of the District meanwhile all was well; and from the beginning of April 1898 to the middle of September 1898—nearly 6 months—no plague of any kind was reported.

Second Epidemic.—After the above outbreak at Kaládgi had subsided, no more was heard of plague in the Bijápúr District till the middle of September 1898, when the town of Ilkal was attacked and suffered from a short but rather severe epidemic. 18 cases—10 deaths were reported as having occurred during the week ending the 23rd September, the first cases being discovered on the 17th of that month; but it is probable that the infection was introduced some time previously, and that undetected cases occurred during the interval. This will be seen from the Collector's report :—

"The outbreak at Ilkal, which occurred on the 17th September 1898, appears to have resulted from an imported case from Hubli. A Márwádi, who had arrived from Hubli, was under medical surveillance at Guledgud, but escaped to Ilkal and died there on the 31st July 1898 in a house in Settar Peth. On the 19th and 20th August two persons died in the same house. Since that there were some suspicious deaths in the same street, but these were not recognized as plague till the 17th September. There was no previous outbreak in the village."

Evacuation was begun by the beginning of October and the Spence Committee rules were applied to the Town. Circle Inspectors were appointed to watch the Dhárwár Frontier, the police being withdrawn. Dr. J. Thomson, English Doctor, was placed in charge of the

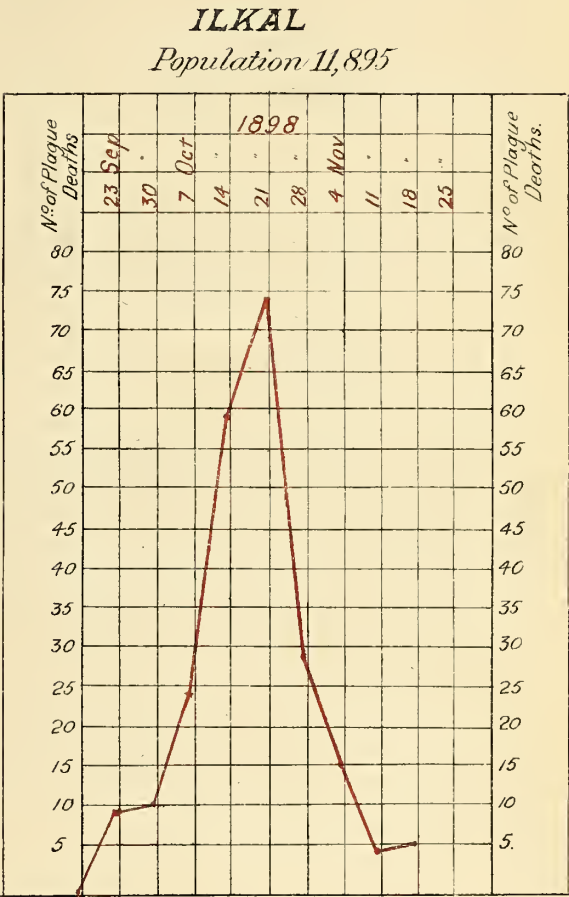
measures at Ilkal, and lost no time in introducing inoculation. Nevertheless, the number attacked increased rapidly up to the 21st October; and during the week ending with that date there were 88 cases—75 deaths.

During the previous week the village of Gorubál had been attacked, and the infection gradually spread over the District.

Meanwhile in Ilkal the disinfection and ventilation of houses was energetically pushed on. Inoculation, too, made good progress: 7,677 people ultimately availing themselves of its protection. The steps taken soon bore fruit; for, from the 21st October, the epidemic declined as rapidly as it had grown. Below are given the weekly plague figures:—

Week ending	ILKAL TOWN. Population—11,895.	
	Cases.†	Deaths.
23rd September 1898 ..	18	10
30th ,, " ...	13	11
7th October ,, ...	31	25
14th ,, " ...	70	60
21st ,, " ..	88	75
28th ,, " ...	32	29
4th November ,, ...	21	17
11th ,, " ...	4	5
18th ,, " ...	7	6
Total ...	284	238

† All indigenous.



The sudden drop in the rapidly rising figures, and the total cessation of plague in Ilkal, after such a brief period, bear eloquent testimony to the success attained by the prompt enforcement of the measures mentioned: and on the 28th October the Collector writes :—

“The town has been entirely evacuated, the only exceptions made being in the case of inoculated families, who show satisfactory immunity. The work of ventilating and disinfecting the houses is energetically proceeded with. During my visit last week I was quite satisfied with the thoroughness of the measures taken by Dr. Thomson.”

The District, as has been stated, was infected during the first week of October 1898. The first villages attacked were Gorubál (population. 624) and Kodihál (population, 1,056). The former was completely evacuated under the superintendence of Dr. J. Thomson, whose head-quarters were Ilkal. The Collector reports on the 23th October of the other village :—

Bijapur District.

“Kodihál, newly infected during the week, is about 12 miles north of Ilkal, and is almost entirely surrounded by the Nizam's Territory. The cases are confined to an isolated quarter of the village which has been evacuated. A Hospital Assistant has been despatched there.”

The Collector, in consultation with Dr. J. Thomson, and other officers, drew up a scheme of plague operations for the Hungund Táluka, so far the only one infected. The decisions arrived at were that Temporary Assistant Surgeon R. B. Redkar, with some Hospital Assistants, should at once visit every village as it was infected. The number of infected villages rose rapidly; 8 returning cases on the 11th November, 13 on the 2nd December, and 20 on the 30th December. The measures in the villages themselves were eminently successful; but no sooner did one village shake itself clear of plague than two more were attacked. At first the infection was confined to the Hungund Táluka, but on the 1st December 1898 the Collector reports the fall of Krishnápúr and Kesarbhárv (Hungund Táluka).

Evacuation was carried out in the most prompt and thorough manner; but the Collector was short-handed. Dr. J. Thomson and Assistant Surgeon Redkar were no longer able to keep pace with the spread of the pestilence in their flying visits to newly-infected villages; heavy rain fell towards the middle of November, which resulted in the people taking french-leave and returning to their houses in the town; and the village officials were in some cases unequal to the demands of the occasion.

Lieutenants H. Ross and H. B. Birdwood, I. S. C., were, therefore, sent in December 1898 to strengthen the Collector's hands; and the Surgeon-General with the Government of Bombay was asked to send him more Hospital Assistants.

Meanwhile inoculation under Dr. Thomson was steadily progressing; 4,962 persons having been inoculated by the 9th of December. Evacuation-in-advance was tried experimentally in several villages which were seriously threatened, the people willingly co-operating. In this connection the Collector says:—

“I cannot sufficiently praise the docility and prudence of the people of Báblesshwar, who have now without the slightest fuss vacated the entire village in two days, and camped in the fields I have found it necessary to cause four more villages around Nidoni and adjoining Jamkhandi and Kurundvád Territory to be evacuated as a precautionary measure.”

At the beginning of December the circle of infection grew still wider. The Collector reports:—

“Plague has now unfortunately appeared in a totally different part of the district. During the week under report two villages of Bijápúr Táluka were found to be infected, *viz.*, Kákhandiki (population, 4,142) and Nidoni (population, 1,982). The distance between the two is 9 miles. In both cases the infection is supposed to have been introduced from the Dhárwár District, although the villagers do not admit it. The former village was already badly seized by the time the fact was discovered, and as both the village officers are reported to have died, and the people are scattered in the fields, there has been some delay in getting daily returns. Unfortunately, the Mámlatdár of Bijápúr, who showed great energy in visiting the villages and making the preliminary arrangements, had to come back to Bijápúr on account of an illness which has since terminated fatally. I have sent Dr. Thomson with one Hospital Assistant to visit the infected localities. He has also been given a Civil Assistant. An additional Head Karkun and 3 extra Circle Inspectors have been put on plague duty in the Táluka. Special police have been posted in both the infected villages.”

The figures for indigenous plague, week by week, up to the end of 1898, of Bijápúr District, with the number of villages infected, were as follows:—

Week ending				INDIGENOUS.		Number of villages infected.
				Cases.	Deaths.	
14th October 1898	...			11	6	1
21st "	"	...		12	2	1
28th "	"	...		20	4	2
4th November	"	...		37	45	5
11th "	"	...		70	53	8
18th "	"	...		43	39	6
25th "	"	...		94	57	8
2nd December	"	...		166	127	13
9th "	"	...		149	127	15
16th "	"	...		122	101	15
23rd "	"	...		114	88	15
30th "	"	...		141	104	20
Total ...				979	753	109
Add—Imported plague.				31	26	
Grand Total ...				1,010	779	

The year 1899 began badly, with 23 infected villages and a total of 172 cases—134 deaths for the first week. On the 10th January, the Collector and the District Superintendent of Police visited Kamatgi, where they met Lieut. Ross, the Mámlatdárs of Hungund, Bádámi and Bágalkot, the subordinate Plague staff and the Guledgud Municipal officers: and lines of concerted action to be taken in the three Tálukas (Bágalkot, Hungund, and Bádámi) were settled. “I have arranged to place a sufficient number of subordinates under Lieut. Ross,” writes the Collector, “to enable him to have each infected village specially watched, together with the adjoining villages which have been, or might hereafter be, evacuated in advance. The total number of villages to be so treated is 54 in the Hungund Táluka. The manner in which the additional police shall be utilized was also settled. I sincerely hope that in this manner it will be possible to stamp out plague from the Hungund Táluka and the District generally by the end of February, when the cold weather will also terminate.”

During the next two weeks the figures fell rapidly:—

Week ending				IMPORTED.		INDIGENOUS.	
				Cases.	Deaths.	Cases.	Deaths.
6th January 1899	...	...		1	1	172	134
13th "	"	"	...	...	...	92	89
20th "	"	"	..	...	...	59	48

But the week after (20th—27th January) they rose again to 117 cases—107 deaths, and though from that time plague steadily subsided, yet the subsidence was more gradual. Of these 117 cases—107 deaths, the village of Bágewádi returned no less than 34 cases—33 deaths, or nearly a third, although over 20 villages were reporting plague.

Inoculation was now introduced at Guledgud and Hungund as a preventive measure, while steadily progressing at Ilkal and Amingad. Unfortunately the supply of serum was insufficient at this time to meet the demand.

Plague now slowly but steadily declined, the chief cause of anxiety being the continued infection of fresh villages throughout the District. Evacuation was promptly enforced in each case with the happiest results; but no sooner did it set free one village than others were attacked. This will be clearly seen from the following statement :—

Duration of Epidemic.	Largest number of villages infected at one time.	Total number of different villages attacked.
From the middle of September 1898 to the end of May 1899.	23 (Week ending 13th January 1899.)	57

Inoculation meanwhile steadily progressed under Dr. Thomson and Assistant Surgeon Redkar. The total number of inoculations performed in the district up to the end of May 1899 are—

Ilkal	...	...	...	...	7,677
Amingad	...	...	...	...	5,066
Guledgud	...	...	...	...	1,597
Hungund	...	...	...	...	4,917
Talihal	...	...	...	...	142
Total ...					19,399

The total number of cases for Bijápur District and for Ilkal Town, month by month, are given below :—

Months.	BIJAPUR DISTRICT (excluding Ilkal Town). Population—784,444.		ILKAL TOWN. Population—11,895.	
	Cases.	Deaths.	Cases.	Deaths.
September 1898	1	1	31	21
October	48	16	221	189
November	255	201	32	28
December	701	553	...	...
January 1899	459	372	...	...
February	322	292	...	...
March	159	134	...	...
April	41	37	...	...
May	14	3	...	...
Total of Epidemic, 1898-99	2,000	1,619	284	238

Since May 1899, there has been some plague in the Bijápur District. The month of June was practically free; but an epidemic began in the beginning of July which reached the number of 150 cases—121 deaths in the week ending 8th September. The total figures from the 2nd June up to the 15th September 1899 were 842 cases—669 deaths.

DHARWAR DISTRICT.

Area	...	...	...	...	4,603 sq. miles.
Population in 1891	...	...	...	...	1,051,314.
Density of population	...	...	...	...	228 per sq. mile.
Rainfall	...	...	...	...	from 25 to 40 inches.

The Dhárwár District—of a shape very similar to that of the Continent of Africa—is bounded on the north by Belgaum District, Rámdurg State, and Bijápur District; on the east by the Nizam's Territory and Bellary (Madras); on the south by Mysore; on the west by North Kánara and Khánapur (Belgaum). It varies in breadth from 70 miles in the north to about 40 miles near Kod in the south. As it has suffered more severely than any other District so far attacked, it deserves detailed notice.

The Poona-Harihar Road—running from north-west to south-east—divides the Dhárwár District into two very dissimilar and unequal parts—on the west, an irregular belt of hilly and woody country, 25 miles broad; on the east, a bare plain extending towards the north-east some 60 miles. Of the narrow western belt, the country is hilly and wooded, the soil red and gravelly, the air cool, the rainfall 30—40 inches, and the water-supply on the whole abundant. Its villages are, as a rule, close together, on rising ground with shady sites: their inhabitants poor but hard-working. Of the broad eastern plain, the country is flat and bare, the soil black, the rainfall 20—30 inches, and the water-supply scanty and in places brackish. Its villages are large, separated, poorly shaded; their inhabitants rich and skilful husbandmen. The climate of the District as a whole is healthy and agreeable. It is pleasantest within a tract parallel with the Sahyadri crest—between the western forests and the treeless east—a tract whose limits would be delineated by the junction of Dhárwár, Bankapur, Kod, Hubli and Dhárwár. The year may be divided into five seasons: shower months—April to June; south-west rains—June to October; north-east rains—October and November; cold weather—December, January, and half February; hot weather—middle of February to middle of April. April is the worst month. The first half is the hottest period of the year: and throughout this month whirlwinds or dust-storms are common. These take the form of waterspouts, travelling erratically hither and thither with great force, violence and noise.

There is no previous history of plague in Dhárwár. Cholera and intermittent fever have been the two great sources of epidemic disease there.*

Up to the middle of October 1897, no case of plague, either imported or indigenous, was reported from the Dhárwár District. In that month, however, a few imported cases occurred in Hubli and Gadag; and, during November 1897, in Hubli, Dhárwár and Gadag: besides these imported cases, there were a few indigenous cases at Hubli. From the beginning of December 1897, Hubli alone returned plague of any kind; and even then the plague returns were only two or three cases a week, chiefly indigenous. These sporadic cases at Hubli continued throughout December 1897, and January, February, March, April and May 1898. With June 1898 came a change for the worse; for although Hubli still remained the only infected place in

* *Bombay Gazetteer*, Vol. XXII.

the district, double figures were returned every week. The position was now an anxious one ; and the worst anticipations were unfortunately destined to be realized. July saw a marked increase in the severity of the Hubli epidemic, and the infection of Dhárwár and Gadag. In August, the figures in Hubli reached their climax—515 cases—425 deaths (week ending 26th August 1898)—and the infection spread with terrible rapidity. Throughout September, October, November and December 1898, the Dhárwár District suffered from the severest epidemic yet recorded since the beginning of plague in September 1896. During the week ending the 11th of November 1898, over 100 villages returned a total of 2,646 cases—2,202 deaths : and up to the 2nd June 1899 the Dhárwár District reported 38,066 cases—30,875 deaths from over 320 villages.

As has been said, the first case of plague reported from the Dhárwár District occurred at Hubli on the 17th October 1897: and the weekly figures from that date up to the 31st December 1897 were as follows :—

Week ending			HUBLI.		DHARWAR.		GADAG.		REMARKS.
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	
22nd October	1897	...	4	3	1	...	<i>Dhárwár and Gadag—All imported.</i>
29th	"	...	4	3	...	...	2	2
5th November	"	...	10	6	<i>Hubli—3 cases and 3 deaths imported (week ending 5th November 1897); the rest all indigenous.</i>
12th	"	...	8	7	...	...	...	1
19th	"	...	6	6	1	...	...	...
26th	"	...	...	4	1	2	...	...
3rd December	"	...	2	4	...	...	...	...
10th	"	...	2	2	...	...	...	...
17th	"	...	3	3	...	...	...	...
24th	"	...	2	1	...	...	...	...
31st	"	...	...	...	...	...	...	...
Totals ...			41	39	2	2	3	3	

On this little outbreak at Hubli, and on the measures taken to check its development and spread, a Commission, consisting of Surgeon-General Cleghorn, Mr. (now Sir) A. Wingate, and Colonel Hay, I. M. S., who visited Hubli in November 1897, reported as follows :—

"There are extensive railway workshops established here, the employés residing in barracks situated in close proximity to the workshops. These barracks are about a quarter to half a mile distant from the city, and were occupied by about 1,500 men, women and children.

"The first case of plague was reported on the 17th October and occurred in one of the barracks occupied by a Punjabi who, it was stated, had been on a visit to Sholápur. On the appearance of other cases preparations were made for the eventual evacuation of the quarters. A hospital and observation wards were erected in one field, and segregation huts for the healthy in another. There was no vacant space in the immediate neighbourhood, and a sufficient area for the huts could only be obtained by removal of the standing crops.

"Evacuation of the barracks was commenced on the 30th October and was completed on the 13th November. The personal effects of all those removed to the huts were disinfected in the perchloride of mercury solution, and all rags and refuse were burnt. As each house or room was emptied, the door was, for the time being, securely fastened with screws and the whole roof removed.

"On arrival in camp a register was kept of the members of a family occupying each hut, and a cordon of Police was placed around the encampment with orders to prevent all egress. A roll-call was instituted every morning and an inspection made by railway officials of all residents.

"There are now about 1,500 men, women and children residing in these huts, 1,200 in one camp, 300 in another and 55 in the segregation and observation sheds connected with the hospital.

"Water is laid on to the larger camp, and wells are available for the others. Supplies are obtainable from bunniahs who have opened shops in close proximity to each camp.

"The total number of plague cases which have occurred up to date has been 26, twelve of which appeared in the barracks, twelve after removal to the huts, and two imported into the city from the railway quarters.

"The disease from the first has been of a serious type, and the cases have ended fatally within a short time after the first appearance of the symptoms . . . The necessary work in connection with disinfection will be commenced at once, but it will necessarily occupy some time . . .

"Two residents of the barracks went to live in the city, where they were discovered to be suffering from plague and were promptly removed to the hospital. The houses which they occupied in the city were vacated, cleaned and disinfected. These are the only cases as yet which have been reported from the city. All deaths are certified, and there is no reason to believe that plague exists there at present, but, as an additional check, the Collector has been advised to issue orders for the registration of all funerals as they pass the octroi posts . . .

"Several of the towns in Dhárwár are very populous, and it is highly desirable that every legitimate means should be employed to prevent plague gaining an entrance into them. We have, with this object in view, suggested to the Collector that an inspection and disinfection station should be established here, at Gadag, and at a station to the west of Dhárwár."

Inspection and disinfection stations were accordingly opened at Gadag and Dhárwár, and every possible precaution taken, not merely to stamp out the disease in Hubli, but to prevent its spreading to any other place.

On the 25th November 1897 there were 1,500 men, women and children in camp, and up to that date 32 cases of plague had been reported. Of these cases—

15 occurred in the barracks ;

15 after removal to the huts ;

2 were imported into the city from the Railway quarters.

The disease was of a virulent type, 29 of these 32 cases ending fatally in a very short time.

These prompt and energetic measures were, however, apparently successful in keeping the scourge at bay for some months ; for, with the exception of rare and isolated cases—many after long quiescent periods—Hubli was practically free from plague.

Credit should be here given to the Railway authorities for the help they afforded the Collector in his efforts to ward off an epidemic.

Isolated, imported, and indigenous cases excepted, therefore, Hubli was practically free from plague from the 24th of December 1897 to the 15th April 1898, the total number of cases between these dates being 13 (7 imported). From the 15th April, however, the disease was never quite absent ; and from the beginning of June the figures rose steadily.

Climatic conditions were at this time unfavourable. With the rains beginning, proper shelter outside the town could not be afforded to persons turned out of their houses : evacuation was an impossibility. Previous to this (in February 1898), the Collector had recourse to the drastic measure of burning down houses to stamp out the disease : and some 250 houses were actually thus disinfected. But such a measure must necessarily be limited in its application.

An appeal was, therefore, made to inoculation ; and it was eagerly supported by the people. By the beginning of June over 2,000 inoculations had been performed. From this time a weekly average of over 2,000 inoculations were performed, until by the beginning

of October practically the entire population had availed themselves of its protection : no effort being spared to increase its popularity.

Unfortunately, the pestilence had wrought its havoc before inoculation could prevent it. From the 1st of July 1898 the disease, discarding the restraints placed upon it, assumed epidemic form. In that month the attacks rose from 38 (week ending 1st July) to 169 (week ending 29th July), and from this again in four great strides they reached the climax of 515 (week ending 26th August), from which time the disease began to subside.

The weekly figures were as follows :—

Week ending	Cases.	Deaths.	Inoculation Totals.
1st July 1898	38	26	9,443
8th " "	61	53	11,746
15th " "	75	54	14,269
22nd " "	110	92	16,970
29th " "	169	137	21,824
5th Aug. "	209	172	23,727
12th " "	390	323	28,831
19th " "	472	429	31,641
26th " "	515	425	34,248
2nd Sept. "	422	342	35,382
9th " "	327	282	37,163
16th " "	202	175	37,760
23rd " "	134	117	38,633
30th " "	74	57	39,174
7th Oct. "	56	54	39,589
14th " "	34	36	40,112
21st " "	17	17	40,417
28th " "	8	8	40,604
Totals ...	3,324	2,808	40,604

The following table shows the total number of inoculated with the total numbers of cases and deaths that occurred amongst them : full details are given in Captain B. F. H. Leumann's report, published in accordance with Government Resolution No. 786-P of the 2nd February 1899 :—

Total once in-oculated.	Total twice in-oculated.	Total inoculated (once and twice).	Total cases.	Total deaths.
5,661	38,665	44,326	488	372

Three points call for especial notice—

- (i.) Immunity of inoculated persons : and increasing death-rate amongst non-inoculated people.
- (ii.) The spread of infection from Hubli.
- (iii.) Rats.

(i.) The following statement, based on the Collector's weekly reports, may be interesting :—

Week ending		Inoculated.	Uninoculated.	Attacks among the inoculated.	Attacks among the uninoculated.	The rate of attacks per mille per week among the inoculated.	The rate of attacks per mille per week among the uninoculated.
19th August	1898	... 32,000	8,500	69	417	·2	490
2nd September	„	... 37,196	1,014	32	393	·9	387
9th	„	... 36,795	1,587	47	261	1·33	216

(ii.) The infection did not spread from Hubli till August 1898, thanks to the Collector's excellent measures and to the cordial assistance of the Railway authorities. But once started, it spread with amazing rapidity. Dhárwár caught the disease on 9th August; since which time it has raged with terrible violence throughout the District.

The following gives a general idea of the spread of the infection :—

Hubli was infected, October 17th, 1897.

No spread till August 1898, when in the successive weeks—

August 12th—there were 4 places attacked,

„ 19th— „ 8 „

„ 26th— „ 15 „

until on—

November 18th— „ 138 „ in the Dhárwár District.

It is interesting to compare this dissemination with that in the Belgaum District, where it was much slower.

Belgaum was first infected on the 29th November 1897.

The infection did not spread to more than one or two villages till the—

11th February 1898, when 8 villages in all were infected.

On the—

18th March 1898 there were 14 places in all infected.

The disease then remained stationary for a month or two; and it was not until the—

8th July 1898 that 18 places were infected.

On the—

16th September 1898 there were 47 places infected.

On the—

25th November 1898 there were 55 places infected.

(iii.) The connection of rats with this epidemic has apparently never been traced. The following is the Collector's note on the subject :—

“ It has been decided to offer a reward for rats caught or killed in the town. For some months past there has been no history of rats in connection with the spread of the disease, and as this important point seemed to have been lost sight of, I have had special enquiries made recently, but without result. Infected rats were a prominent symptom throughout the operations in the Railway chawls, and it is curious that they cannot be traced in the town.”

This is the more curious as almost every epidemic on a large scale has been preceded by an abnormal mortality among rats. A strict investigation was made to clear up this point, but without result.

A few imported cases excepted, Hubli Town has been free from plague since December 1898. The total numbers of cases and deaths from the beginning of the epidemic to the 2nd June 1899 are as follows :—

From 17th October 1897 to 2nd June 1899.	IMPORTED.		INDIGENOUS.		TOTAL.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Hubli Town (<i>Population</i> —52,595)	84	68	3,495	2,963	3,579	3,031

On the 15th of July 1898, His Excellency the Governor, accompanied by the Plague Commissioner, visited Hubli, inspected all the arrangements, and received an address from the Municipality.

Dhárwár Town had long been menaced before it was attacked. Imported cases occurred as early as November 1897 in the Observation Camp which was in the charge of Mr. L. C. Crump, I. C. S. These came from Belgaum Cantonment. As cases were occurring at Hubli, and it was feared that Dhárwár might be attacked, Mr. E. L. Cappel, I. C. S., the Collector, introduced a general scheme organizing the health operations for the town; appointed ordinary and special plague authorities; divided the town into wards, each in charge of a Supervisor; and ordered the keeping of a Census Register. Doubtless, it was partly due to these precautions and this vigilance that Dhárwár escaped so long; but whatever the cause, for the next seven months Dhárwár remained undisturbed by plague of any kind. One solitary imported case (from Belgaum) was indeed reported in April 1898.

But the sudden onset of plague in Hubli left little hope of Dhárwár's ultimate escape: for, from June 1898, imported cases occurred with increasing frequency: and at length, in August 1898, Dhárwár fell. With the fall of Dhárwár, anxiety for the rest of the District was doubled: for, with Hubli and Dhárwár both badly infected, the District was seriously threatened; and subsequent events proved this anxiety to be only too well grounded.

In Dhárwár, plague broke out first as in Belgaum, in a quarter inhabited by low and dirty classes, such as the 'Kakars,' 'Kasais' and 'Waddars.' The evacuation of this quarter undoubtedly checked the progress of the disease, but there were signs that it had also invaded other parts of the town; and a serious epidemic had at last to be faced. As in Hubli, so in Dhárwár, inoculation was energetically pushed: and, although the entire population were not inoculated, more than half the inhabitants availed themselves of its protection. On the 6th January 1899, the progress and results of inoculation were as follows :—

	Numbers.	Total cases.	Total deaths.
Once inoculated	1,907	141	55
Twice inoculated	9,978	41	21
Uninoculated*	Varying	1,190	929

* Of these 1,256 were specially exempted on account of age, sickness, etc.

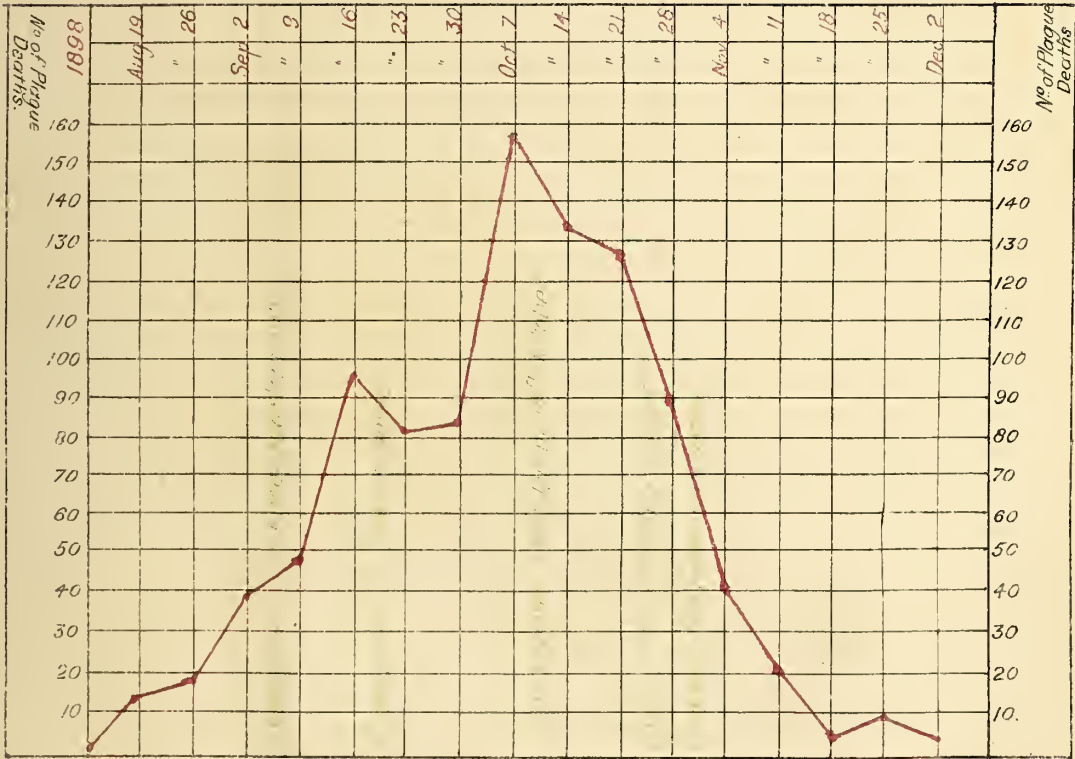
Note.—Over 17,000 inoculations had been performed at this date in Dhárwár Town: but only the above proportion of the inoculated remained in the town.

The figures rose rapidly ; while at the same time an exodus began which ultimately diminished the population by nearly 30,000.

The following statement shows the gradual rise of the plague and the exodus:—

Week ending				Actual popu- lation, week by week, during the epidemic.	Population by Census of 1891.	Cases.	Deaths.
August	26th, 1898	...	...	35,552	32,841	23	19
September	2nd "	...	...	33,753		40	39
"	9th "	...	...	33,039		55	46
"	16th "	...	...	32,619		102	96
"	23rd "	...	...	30,262		118	81
"	30th "	...	...	30,000		128	85
October	7th "	...	...	Census be- ing taken.		185	156
"	14th "	...	...	12,172		167	133
"	21st "	...	...	1,1402		175	124
"	28th "	...	...	10,163		122	89
November	4th "	...	...	9,720		64	42
"	14th "	...	...	9,850		32	22
"	18th "	...	...	10,081		12	6
Average population throughout the epidemic				21,551	32,841	1,223	938

DHARWAR TOWN
Population 32,841



The actual percentages of attacks and deaths were, therefore, 5·5 and 4·3 on the population. The experience gained at Hubli was fully utilized in Dhárwár : Plague Hospitals were built and set apart : Camps were established : inoculation was vigorously introduced : evacuation was ultimately almost complete : the disinfection of houses was prompt and thorough. The great demand for timber and building materials was met by an arrangement made with the Forest Department for the direct retail supply of timber to applicants at reduced rates : a depôt was opened : and the remission of the royalty fee was much appreciated by the people.

A Plague Relief Fund was also started for those in distress from the ravages of plague.

Details of the inoculation measures are given in Government Resolution No. ⁵³³¹ 5923-P, dated 19th October 1898.

The Plague Staff at Dhárwár was distributed as follows :—

- Major T. H. Hardy, I. S. C., Superintendent, Plague Operations.
- Dr. (Miss) A. M. Corthorn, in charge of Inoculation work.
- Dr. R. Hornabrook, in charge of Inoculation work and Plague Hospital, Dhárwár.
- Miss M. Murphy, } Lady Nurses, Plague Hospital, Dhárwár.
- „ E. Riley, }

The following table shows the number of cases and deaths in Dhárwár Town, month by month, from August 1898 to February 1899 :—

Month.					IMPORTED.		INDIGENOUS.	
					Cases.	Deaths.	Cases.	Deaths.
August	1898	...	...	...	4	5	36	27
September	„	...	...	...	...	...	443	347
October	„	...	...	...	1	1	649	502
November	„	...	...	...	3	...	126	79
December	„	...	...	...	7	4	23	17
January	1899	...	...	...	61	3	4	3
February	„	...	...	...		1	1	1
Total					22	14	1,282	976

Towards the middle of October 1898, a slight outbreak occurred among the inmates of the Dhárwár Jail, who then numbered 364. The first attack was on the 19th October, and being promptly discovered was prevented from communicating infection. But on the 24th, a new arrival, who was kept under observation before admission, developed plague and a prisoner was attacked on the following day. Thereupon Major Corkery prevailed on the inmates to get themselves inoculated, and the operation was completed by the 6th November. In the meanwhile three cases occurred on the 28th October, 3rd November, and 6th November, one of the cases being that of a prisoner inoculated two days before attack. He recovered, while the other two died, and there were no further cases.

Gadag, the third town in which inoculation was successfully tried, was attacked in November 1898. A few imported cases had previously occurred (July, August, and October 1898) before indigenous plague was discovered towards the end of October 1898. Up to the

Gadag.
Population—23,899.

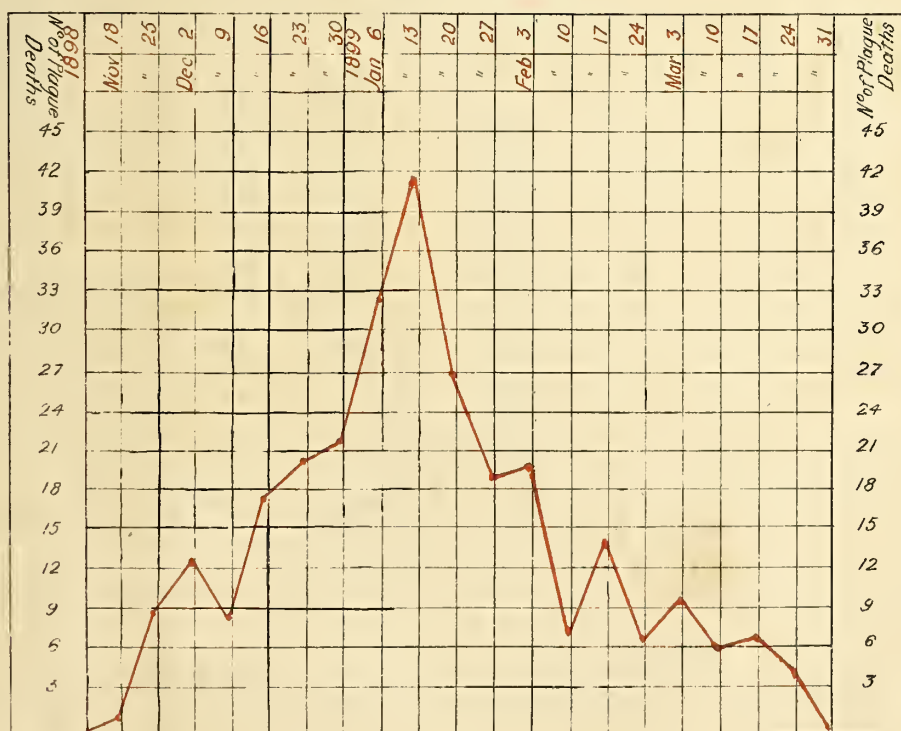
end of November but few cases occurred: 23 cases (14 fatal) in all. Inoculation was introduced from the very first, and on the 25th November 1898 the figures were as follows: once-inoculated—3,242; twice-inoculated—1,720; total inoculated—4,962, or about one-fifth of the inhabitants.

The following statement shows the progress of inoculation and of plague, week by week, in Gadag Town:—

Week ending	Total number of inoculated once and twice.	Total number uninoculated.	TOTAL.		AMONG THE INOCULATED.	
			Cases.	Deaths.	Cases.	Deaths.
9th December 1898	5,715	17,659	40	25	...	...
16th " "	7,821	13,835	32	17	3	2
23rd " "	8,794	11,772	31	20	4	1
30th " "	10,382	8,726	42	22	4	3
6th January 1899	10,341	6,145	36	25	12	7
13th " "	11,117	3,381	53	41	16	6
20th " "	11,359	2,635	26	27	14	7
27th " "	11,612	1,766	34	19	14	7
3rd February	12,048	1,135	34	20	13	6
10th " "	11,923	907	19	7	18	6
17th " "	11,703	723	30	14	23	8
24th " "	11,525	732	12	7	22	8
3rd March	11,907	713	25	10	19	7
10th " "	12,361	719	4	6	7	4
17th " "	12,871	696	13	7	8	...
24th " "	13,754	712	3	4	2	3
31st " "	14,026	688	1	...	3	2
	14,036	Varying.	435	271	182	77

GADAG

Population 23,889.



With a few dropping cases in April, the epidemic in Gadag died out ; from the beginning of May the town was free from plague. Throughout May and June 1899 this freedom continued, but in July the town was again attacked and suffered from an epidemic which lies outside the scope of the present review. The same is true of Hubli and Dhárwár Town and of the District.

As has been already shown in paragraph 15 (ii.) the spread of plague in Dhárwár District was rapid. Over 320 places in all were ultimately affected ; it is, therefore, impossible to do more than review the progress of plague as a whole. The early months of the epidemic in the district were August, September, and October, the rainy months, and evacuation and cognate measures were practically impossible. To this fact may perhaps be attributed the very wide dissemination of the disease and the severity with which individual villages suffered.

It is possible, however, to divide the epidemic roughly into three periods, first, the period of rain, during which it was impossible to do much ; second, a brief period after the cessation of the rains, during which evacuation and cognate measures were being energetically enforced ; thirdly, the subsequent period which would show the result of the measures taken during the second period.

First period (5th August—11th November 1898).—During this period the rains were so heavy and continuous that, as has been said, little or nothing could be done ; and the following statement shows the weekly numbers of cases and deaths, the total number of places infected during each week, the number of places newly infected weekly, and the total number of places infected during this period :—

Week ending	Total in District. Indigenous.		Total number of places which reported indigenous plague during the week,†	Number of places newly infected during the week.	Total number of places which had indi- genous plague during period stated.
	Cases,*	Deaths.*			
5th August 1898	191	162	2	1	}
12th " "	400	316	5	4	
19th " "	809	671	13	5	
26th " "	879	657	16	10	
2nd September " "	765	589	25	2	
9th " "	1,038	885	35	7	}
16th " "	1,642	1,300	39	4	
23rd " "	1,083	916	46	10	
30th " "	2,074	1,683	53	5	
7th October " "	1,671	1,424	66	10	
14th " "	1,539	1,237	76	20	}
21st " "	2,368	1,914	78	8	
28th " "	2,286	1,387	84	11	
4th November " "	2,128	1,558	91	5	
11th " "	2,924	2,358	94	12	
Total	21,797	17,057

* The figures are taken from the daily reports,

† This column does not show the total number of places infected during the week, as many places which were infected did not return any cases or deaths during certain weeks, and are, therefore, not included in the figures in this column.

*Second period (12th November—2nd December 1898).—*The following statement gives the same information for this second period :—

Week ending	Total in District. Indigenous.		Total number of places which reported indigenous plague during the week.†	Number of places newly infected during the week.	Total number of places which had indi- genous plague during period stated.
	Cases.*	Deaths.*			
18th November 1898	2,194	1,857	94	12	} 133
25th " " " " "	2,344	1,876	97	6	
2nd December " " "	1,846	1,562	100	5	
Total	6,384	5,295	...	...	...

*Third period (3rd December 1898—3rd March 1899).—*During this period evacuation, segregation of contacts, disinfection of vacated houses, and similar measures were in full swing. A decrease in the mortality and in the duration of epidemics in infected places might be expected, and indeed this was the case. The information for the third period is given in the following statement :—

Week ending	Total in District. Indigenous.		Total number of places which reported indigenous plague during the week.†	Number of places newly infected during the week.	Total number of places which had indi- genous plague during period stated.
	Cases.*	Deaths.*			
9th December 1898	1,412	1,143	92	13	} 280
16th " " " " "	1,200	1,035	98	13	
23rd " " " " "	1,241	1,061	111	13	
30th " " " " "	1,080	860	107	26	
6th January 1899	806	682	94	12	
13th " " " " "	792	641	94	12	
20th " " " " "	495	467	84	9	
27th " " " " "	285	238	81	7	
3rd February " " " "	195	139	66	5	
10th " " " " "	360	255	59	10	
17th " " " " "	344	253	54	9	
24th " " " " "	292	235	46	7	
3rd March " " " "	118	87	37	4	
10th " " " " "	104	89	44	3	
Total	8,734	7,185

Altogether in the Dhárwár District over 320 places were attacked by plague; some of these suffered with exceptional severity, in some cases as much as one-third of the population

* The figures are taken from the daily reports.

† This column does not show the total number of places infected during the week, as many places which were infected did not return any cases or deaths during certain weeks, and are, therefore, not included in the figures in this column.

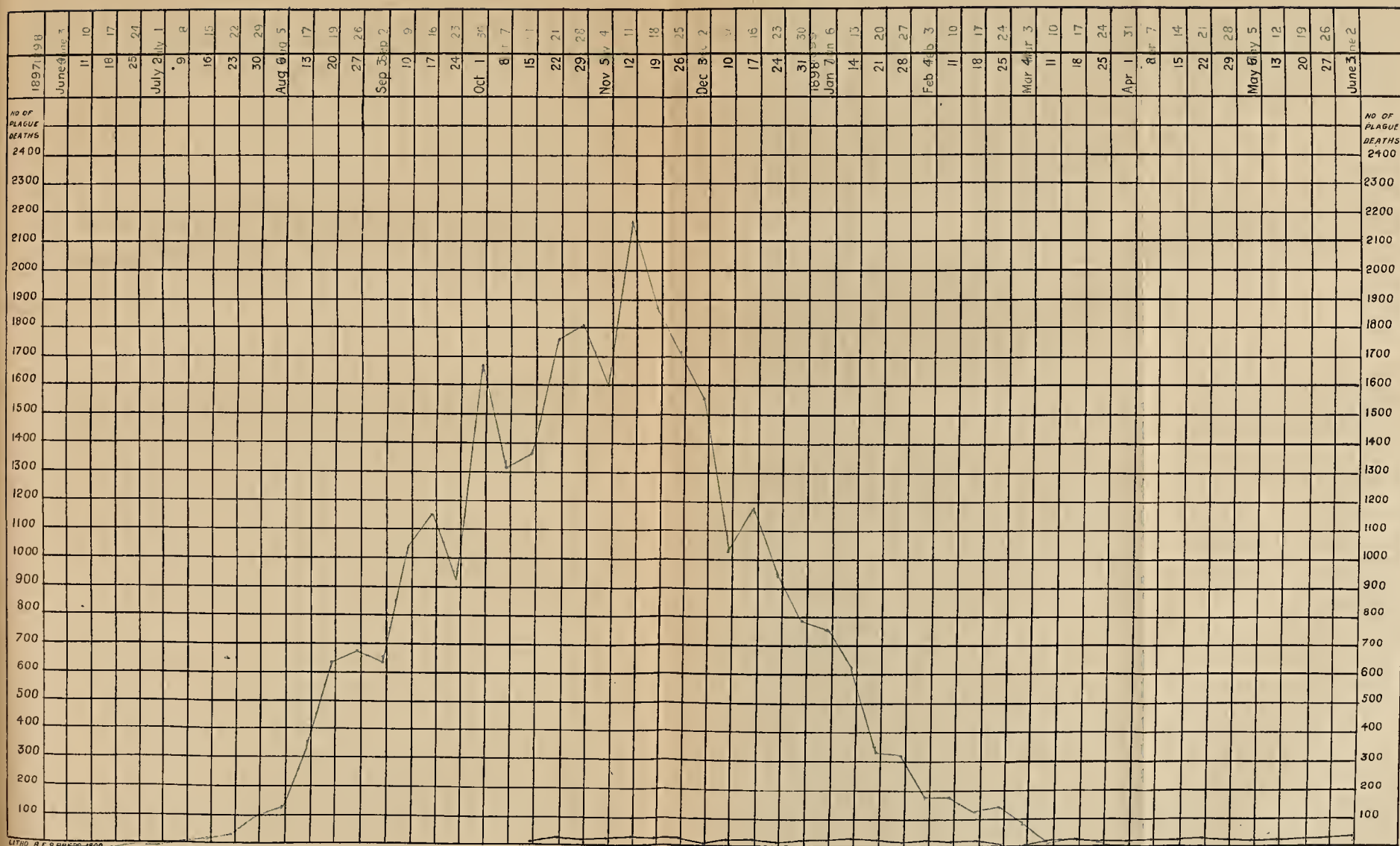
being destroyed by the disease. The following statement gives the duration and incidence of plague in those places which suffered most severely :—

Place.	Population.	Duration of Epidemic.		Total.		Percentage mortality on population.
		From	To	Cases.	Deaths.	
Shelwadi ...	4,222	Oct. 1898 ..	Dec. 1898 ..	1,376	1,154	27·33
Byahatti	3,589	Sept. „ ..	„ „ ..	1,097	782	21·78
Ingalhalli	2,203	Aug. „ ..	Nov. „ ..	1,048	807	36·63
Malapur	1,816	Oct. „ ..	Dec. „ ..	664	545	30·01
Ibrampur	1,692	„ „ ..	„ „ ..	869	610	36·05
Bhandivad	1,306	Aug. „ ..	Oct. „ ..	501	482	36·90
Datanhal	1,280	Oct. „ ..	Nov. „ ..	554	432	33·75
Umashigi	1,162	Aug. „ ..	Oct. „ ..	332	328	28·22
Total ..	17,270	.....	.. ..	441	5,140	29·76

Besides these places, many other small villages suffered even more severely.

DHARWAR DISTRICT

Chart showing Plague Mortality



KANARA DISTRICT.

Area...	...	...	...	...	...	...	3,944 sq. miles.
Population in 1891	...	...	...	...	...	...	446,351.
Density of population	...	...	...	...	...	...	113·17 per sq. mile.
Rainfall	...	...	...	...	...	...	About 100 inches.

Kánara, the southernmost part of the Bombay Presidency, is a belt of country about 110 miles from north to south, and from 10 to 60 miles from east to west. It is bounded as follows:—On the north, by Bidi in Belgaum; on the east, by the Dhárwár, Kalghatgi, Bankápur, and Hángal sub-divisions of Dhárwár, and by Maisur (Mysore); on the south-east, by Maisur; on the south, by Maisur and South Kánara; on the west, by the Arabian Sea and Goa; and on the north-west, by Goa.

Compared with the neighbouring Districts of Belgaum and Dhárwár, Kánara is unhealthy. In spite of an average rainfall of over 100 inches, the coast sub-divisions are more healthy than the forest-covered uplands. Of the feverish inland tracts, the valleys of the Kálinadi and its tributaries are perhaps the most unhealthy. Throughout the District, especially above the Sahyadris, the two most unhealthy seasons of the year are the two first rainy months, June and July, and the four cool months, November to February.

There are four chief rivers, the Kálinadi in the north, the Bedti or Gangávali about 20 miles south, the Donihalla or Tadri, and the Bálánadi or Gersappa river about 15 miles south of the Tadri. The Gersappa river contains the famous Gersappa falls, 890 feet high, forming a most picturesque water-fall, among the highest in the world. Neither in Upland nor in Lowland Kánara are there large lakes or reservoirs. In the forests the water is so laden with vegetable matter that even running streams are dangerous to drink. At the upper ends of the valleys a red alluvial soil called *kagdali*, with shining particles of mica, is often found; and near the mouth of the valleys is a still richer soil called *bailu*. In the western belt the lowlands are under tillage, and most of the forests are found on the spurs that run west from the Sahyadris, in some cases to the sea. The soil is red and gravelly, ill suited for teak, which, when found, is stunted and insignificant.

There is no authentic record of plague in this District previous to 1896. In 1860, however, Kánara suffered severely from an outbreak of fever which lasted for 8 years. The fever was sometimes remittent, but mostly intermittent, of the usual daily, third-day, and fourth-day types.*

The Kánara District has escaped more lightly than any other District attacked by plague; the Ahmedabad District, perhaps, excepted. Up to October 1897 it was, indeed, scarcely menaced; and although Belgaum and Dhárwár, which bound it on the east, were infected in that month, it was not till a full year later that plague established itself in Kánara. One

Kánara District.
Population—446,351.

* *Bombay Gazetteer*, Vol. XV.

solitary case—one of the very first that was discovered in the Southern Division—had been imported in October 1896 in the Kumta Táluka ; but the infection did not take root. The method and energy with which preventive measures were introduced, and the careful scrutiny, week by week, of the mortality all over the District, doubtless largely contributed to this happy immunity.

Precautionary measures practically began on the 9th of August 1897, when the District Magistrate was appointed a Special Plague Authority by the Commissioner, S. D., and was at the same time requested to do his utmost to protect his District from the introduction of the pestilence. Thus called upon, the Collector at once directed his attention to the necessity of watching arrivals from infected places ; and Observation Camps were established at all the ports on the west coast at which steamers called—at almost all the places of entrance on the eastern land-boundary—and on the Goa Frontier on the north. All passengers were medically examined, and, after their names were noted down, were allowed into the District ; only those that actually had fever or swellings being detained. These latter remained under observation for a period of eight days. For the first few months, people whose temperature was higher than normal, or who came from infected districts without passes, were compelled to present themselves for examination for eight days after arrival. Later on, when the chances of infection increased with the increase of plague in the Southern Marátha Country, it was considered advisable to detain all persons who could not produce proper health certificates, with the exception of those who being free from suspicious symptoms, furnished security for their due presentation for daily medical inspection for the prescribed period of eight days. People detained in Camps were daily examined by Hospital Assistants and also visited by Plague Authorities.

From all the municipal towns, where an exodus from affected localities was probable, weekly mortality returns were called for ; and any abnormal excess in the death-rate thoroughly investigated. Important municipal areas were divided into wards, or blocks, and given into the charge of supervisors, whose duty it was, not only to look to the sanitary condition of each ward, and the limewashing of all the houses therein, but also to watch the health of the inhabitants, especially of all new-comers. Plague Authorities were directed to do all they could to prevent the inspection of persons from affected parts being a farce on the one hand, and a cause of needless inconvenience on the other, caste prejudices being, as far as possible, respected.

By these means not only was protection from attack sought, but the people were taught to prepare themselves for a possible outbreak, so as to prevent a rude shock, and the plea of helplessness, if an epidemic should declare itself. The event proved the wisdom of this action, for, with characteristic suddenness, plague appeared.

Without so much as an imported case for the space of two years, 2 imported and 3 indigenous cases, all fatal, preceded by the death of rats, were reported in a single week—that ending 30th September 1898—all, with one exception, at Hungund. Both the imported cases were from Dhárwár, the most potent source of infection for Kánara ; one of them was discovered at the Castle Rock Station, the other at Hungund in the Mundgod Petha, which was also responsible for the 3 indigenous cases. But the authorities were not unprepared. On the 1st October the Collector reports—

“ One Hospital Assistant, two Police Head Constables, and 16 Constables have been given to the assistance of the Mahálkari of Mundgod. The village site has been ordered

to be evacuated, and nearly three-fourths of the population have left their houses, and now live in temporary sheds erected by them in the fields and jungles. Rats were infected before human beings. All the inmates of the houses where deaths occurred from plague have been segregated. Disinfection of infected houses is progressing. Nobody is allowed to leave the village at present."

Next week there were 5 cases, all again fatal, at Hungund; but none elsewhere in the District. "Nearly the whole village," writes the Collector, "has been evacuated." Two more cases occurred in the succeeding week (15th—21st October 1898); and the whole village was empty. Mr. W. T. W. Baker, I.C.S., Assistant Collector, was sent to Hungund, and also an extra Hospital Assistant. Steps were at once taken to prevent the spread of infection outside the village. Hungund itself, after returning 4 cases in the last week of October 1898, was practically free, as only four more sporadic cases occurred there at intervals of a fortnight each. The last case, which was due to outside infection, occurred in a hut beyond the village in the week ending 27th January 1899. The precautions taken to combat the spread of the disease beyond Hungund were completely successful, as not a single case escaped to any other place.

But whether it was that the outbreak of plague within the District had demoralized the frontier guards, or tended to slacken their vigilance, several cases were now imported from the Dhárwár District into the Mundgod Petha and the Yellápur and Haliyál Tálukas. At no place, however, was the disease allowed to get a footing. As soon as a case occurred or dead rats were discovered, the people left the village site and encamped in the fields; this was generally done very willingly, and, the villages being comparatively small, evacuation could be rapidly accomplished without difficulty. Some cases occurred in the fields where people had temporarily taken shelter. In several villages disinfection was carried out by the people themselves, under the guidance of the District Agricultural Inspector, by slightly digging up the floors and burning a mixture of grass, cowdung, and chaff on the rough surface so made, and allowing it to smoulder for about 24 hours.

With the exception of a sharp attack at Tergaun, a village of some 2,000 inhabitants, which reported 32 cases (26 fatal) in the brief space of three weeks, during the month of March 1899, the only place that suffered from an epidemic of any magnitude was Haliyál Town, situated at a distance of only 21 miles from Dhárwár and 7 miles from the Alnavar Railway Station. "How infection reached that town," writes the Collector, "is not clearly known; but there have been several imported cases."

As in the villages, so at Haliyál, evacuation was resorted to without delay. In the very week in which the first 4 cases were reported (ending 3rd February 1899), the inhabitants of the street in which they occurred were turned out, and a fortnight thereafter the whole of the townspeople had taken shelter in the fields. Dr. E. S. Winter arrived on the 12th February with the particular object of popularizing inoculation. Of this protection, however, the people seemed disinclined to avail themselves, preferring to vacate the town. Nevertheless, the epidemic was speedily arrested, and since the 14th of April the District has been practically free, a solitary case having been reported from Haliyál Town about the middle of May last.

From the subjoined table of monthly attacks and deaths for the whole of the epidemic, it is clear that the District has been exceptionally fortunate in its freedom from plague.

Month,			KANARA DISTRICT (including Haliyal Town). <i>Population—446,351.</i>				HALIYAL TOWN. <i>Population—6,180.</i>	
			INDIGENOUS.		IMPORTED.		Cases.	Deaths.
			Cases.	Deaths.	Cases.	Deaths.		
September 1898	...	...	3	3	2	2	...	...
October	„	...	11	8	5	3	...	...
November	„	...	4	3	3	2	...	...
December	„	...	28	18	4	4	...	...
January 1899	...	...	41	29	...	...	...	...
February	„	...	48	37	5	4	23	20
March	„	...	52	42	...	...	15	13
April	„	...	6	2	...	...	6	2
May	„	...	1	1	...	...	1	1
Total			194	143	19	15	45	36

The chief Town of the District, Kárwár, enjoys the almost unique reputation of not having yet had a single case of plague, either imported or indigenous ; close and constant vigilance being there maintained.

Since May 1899 the Kánara District has been visited by a slight epidemic. After two weeks of entire freedom in the beginning of June, plague returns jumped to epidemic proportion and continued thus from the 16th June to the 11th August. Cases, 244—Deaths, 167. For four weeks thereafter there was a welcome lull, but on the 15th September plague re-appeared (10 cases—9 deaths), and continued in the District till the end of October, when a marked decrease was visible. The numbers of cases and deaths from May 1899 to the end of October 1899 for the whole District being—

379 Cases—298 Deaths.

KOLABA DISTRICT.

Area	2,128 sq. miles.
Population in 1891	594,872.
Density of population	279.55 per sq. mile.
Rainfall	Average 80 inches.

Kolába, with a length of about seventy miles from north to south, and a breadth of from fifteen to thirty from east to west, is bounded
 Boundaries. on the north and north-east by Bombay Harbour and Thána ;
 on the east by Poona and the Bhor State ; on the south and south-west by Ratnágiri ;
 and on the west by Janjira.

The year may be roughly divided into four seasons, the rains from June to October,
 Climate and natural features. the damp hot weather in October and November, the cold
 weather from December to March, and the dry hot weather
 from March to June. The climate of Alibág differs somewhat from the rest of the
 District. It is free from hot winds, and has almost always some sea breeze.
 Either a little before or a little after the beginning of October the south-west wind
 drops and the rain ceases. Clouds continue to hang about : occasionally, with a warm
 wind from the east, there are severe thunderstorms. The air is charged with electricity,
 the sea breeze fails, and the nights are close and oppressive. This is the unhealthiest
 part of the year. The climate, though feverish and relaxing, is perhaps less relaxing
 than Ratnágiri and less feverish than Thána. The chief health advantages of the coast
 tract are the equable climate, the fresh sea breeze, and the comparatively good water.
 Along the coast the sun is seldom oppressive, and the nights, though cool, are not often
 cold. There are four chief varieties of soil : diluvial and alluvial, powdered laterite and trap,
 clayey mould resting on trap, and soil containing marine deposits with much sand and
 other matter in concretion. Of these the first, which is composed of various disintegrated
 rocks of the overlying trap formation, with a varying proportion of calcareous substance,
 is at once the richest and the most widespread. It is red, yellow or black in colour, crumbly,
 and from the drainage of hill streams, free from salt.

Malaria is the prevailing cause of disease ; and there
 Previous epidemics. is no authentic record of plague in this District previous
 to 1896.*

First Epidemic (February 1897—July 1897).—The Kolába District was, from its
 vicinity to Bombay, peculiarly liable to infection ; and it was
 Kolába District.
 Population—594,872. not long before indigenous plague established itself there.

The infection was directly traceable to cases imported from
 Bombay, of which as many as 41—all but one fatal—were discovered between October 1896
 and January 1897 ; and it is noteworthy that, although no very strict or scientific method
 of segregation or disinfection was adopted, the infection in each case died with the patient ;
 for plague did not establish itself in the District in an indigenous form until the beginning
 of February 1897, when Uran and Panvel were attacked. It then spread more or less
 rapidly, and towards the latter part of March attacked Alibág, the head-quarters of the
 District, where it remained for the space of two months. In April 1897, Alibág, Panvel,
 the Theronda hamlets in Revdanda, and Murud in the Janjira State, had to grapple with a

* *Bombay Gazetteer*, Vol. XI.

severe epidemic ; notably the Theronda hamlets, where the pestilence swept away nearly one-third of the population.

While this increase of plague could not but cause the gravest anxiety, the scanty means at the Collector's disposal to combat the epidemic, and the apathy and helplessness of the panic-stricken people, rendered the District an object of yet more concern. Towards the end of April, therefore, Government directed the Collector, Mr. E. Gray, I. C. S., to put himself in communication with the Bombay Plague Committee. The members of the Committee visited several parts of the Kolába District ; and the vigorous measures, which, by their advice, and by the help of their powerful organization, were immediately put in force under the direct supervision of Major Collins, R. A. M. C., succeeded in speedily reducing the epidemic.

The disease, which had thus far steadily grown worse, reached its zenith in the first week of May 1897, and then gradually declined, until, in the last week of July 1897, the village of Chanje in the Uran Mahal was the only place in the District that still reported indigenous plague. This may be termed the end of the first epidemic in the Kolába District, which, as a whole, has scarcely ever been quite free from plague since it was first attacked. The following numbers of cases and deaths had been reported in the District and in the Janjira State between February and July 1897 :—

					Cases.	Deaths.
Alibág Town	...	...	...	..	262	239
Panvel Town	...	...	...	...	179	156
Rest of the District	...	...	...	...	801	707
Total					1,242	1,102
Janjira State	...	...	...	...	289	181

Second Epidemic (August 1897—December 1897).—The month of August 1897 marked the beginning of another epidemic—the second—which happily was not as severe as either that which preceded, or that which followed, it : and, except for a continued though not severe outbreak at Panvel, which was its principal feature, this epidemic formed a sort of connecting link between the two others.

The last case of plague at Panvel had been registered in the second week of June 1897 from which date to the end of August the returns for the town were blank. Then, however, plague suddenly declared itself and threatened to burst into an epidemic. There is no clear history of either a recrudescence or re-infection ; but probably the disease was lurking in the Town and had passed unnoticed. The mortality in August is reported to have been high, and this fact, coupled with the detection of a number of genuine plague cases during the last few days of the month, tends to confirm the suspicion. Be that as it may, plague was recognized in the week ending 3rd September 1897, and 10 cases reported. Mr. Brooke, I. C. S., Assistant Collector, and Dr. Sprague were at once sent there, and instituted house-to-house inspection and disinfection. The services of Assistant Surgeon P. W. Shikare and of Inspector Jenner, who had done very good work during the first epidemic, were again spared by the Bombay Plague Committee, who themselves inspected the arrangements at Panvel on the 12th September. During the week ending

Panvel Town.
Population—10,417.

10th September 1897, there were 17 cases and 11 deaths, but thereafter the outbreak yielded to the energetic measures, and a decrease was soon manifest. Early in October, Assistant Surgeon Shikare was recalled, and at the same time Dr. Sprague's health gave way—not, however, before the Panvel epidemic was well under control, and the chances of an increase at the other affected places were reduced to a minimum. In November 1897 Mr. Brooke replaced Mr. Gray as Collector. About this time plague showed a tendency to rise at Panvel, but was again put down, and, though it lingered until the beginning of April 1898, was never severe.

The Janjira State had been free from July 1897; but in October the village of Mázgaon, which had also suffered during the previous epidemic, was stricken, and, in the week ending 15th December 1897, reported 10 cases. The State Kárbhári ably managed operations, being successful, with the help of evacuation and cognate measures, not only in repelling the outbreak, but in confining it to the limits of the village. In November, there was an improvement, and though the figures were comparatively high in December, plague disappeared in January 1898: not to appear again in the State until October 1898, and then only for the space of three weeks.

With the end of December 1897 the second epidemic in Kolába may be said to end and the third to commence; for, as already observed, plague did not cease in the District since its first appearance in February 1897. The following statement compares the figure at Panvel with those in the rest of the District, and in Mázgaon in the Janjira State, from August to December 1897:—

Month.					PANVEL. Population—10,417.		REST OF THE DISTRICT (excluding Panvel and Mazgaon).		MAZGAON. Population—1,559.	
					Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
August	1897...	...	...	...	...	...	28	19	...	...
September	„	...	...	...	39	30	45	34	...	...
October	„	...	...	...	27	19	28	26	22	15
November	„	...	...	...	32	27	28	20	11	6
December	„	...	...	...	17	16	22	18	26	17
Total ..					115	92	151	117	59	38

The cases in the “ Rest of the District ” were contributed chiefly by Cheul, Roha, Revdanda, and Campoli (Khopowli).

Third Epidemic (January 1898—June 1898).—From the beginning of June 1897, the disease, though constantly present, had not assumed serious proportions. On the contrary, the decrease in the number of cases in December 1897 led to the hope that ere long the Kolába Diststrict would see the last of plague. In the last week of that month there were but seven indigenous cases, four of which were returned from Panvel Town, and one from Revdanda. Attention was, therefore, directed to the necessity of observing arrivals from infected places, and Observation Camps and posts were established at sixteen stations in the District and two in the Janjira State. Some of these Camps were successful in shutting out infection, but others proved powerless to repel the disease, which broke out at some of the very places they were designed to protect, *e g.*, Karanja and Alibág. Altogether about 14,000 people were detained at these Camps (those travelling with passes or depositing a cash security being exempted from detention) ; and 22 cases were discovered among them.

But all efforts to confine the disease to the few places on which it already had a hold, and to eradicate it from them, proved unavailing; nor were the attempts made to prevent the importation of fresh infection more successful. In the first week of January 1898, three places returned 9 indigenous and 2 imported cases; next week, the indigenous cases increased to 17. Yet a further rise was noticed in the third week; and in the last week of the month there were 36 cases—two of them imported—and no less than 8 places infected.

The places chiefly infected in January and February 1898 were Revdanda, Cheul, Nagaon, Kondri and Khálápur; while Panvel was still struggling with a prolonged epidemic the force of which, however, had by this time been broken. In March, Akshi and Alibág were added to the list, besides a number of other places, which, though not badly infected at any time, yet helped materially to swell the number of cases.

Revdanda (including the Theronda hamlets) had been free for about six weeks, when plague broke out afresh with six fatal cases in the week ending 17th December 1897. The origin of the outbreak here, as in most other places in the District, lies buried in obscurity. For the next two weeks there was a lull, but thereafter a revival took place, and the disease continued with unabated force until the end of March 1898, having been at its worst in February. From April 1898 it gradually declined, and after five cases more had been recorded in May, subsided with a final case in the first week of June. The following is the monthly number of cases and deaths:—

Revdanda.
Population—5,900.

Month.	Cases.	Deaths.
December 1897—3 weeks	9	9
January 1898—4 „	29	20
February „ —4 „	37	31
March „ —4 „	42	40
April „ —5 „	13	12
May „ —4 „	5	5
June „ —1 week	1	1
Total ...	136	88

After having enjoyed a three months' respite, the Cheul and Agrao group of hamlets contiguous to Revdanda, came in for a bad epidemic in February 1898, beginning with one fatal case in the week ending 21st January 1898. This was succeeded by seven cases in the following week: and fifteen in the week subsequent to that. There is little to record of the outbreak here, which continued in a more or less intense degree up to the end of March 1898—as in the case of Revdanda—and then slowly declined until it disappeared at the end of May 1898. The monthly number of cases and deaths is as follows:—

Cheul and Agrao.
Population—5,745.

Month.	Cases.	Deaths.
January 1898—2 weeks	8	4
February „ —4 „	41	34
March „ —4 „	34	28
April „ —5 „	17	17
May „ —1 week	6	5
Total ...	106	118

The above figures for Revdanda and Cheul are not large, considering the population; plague may, therefore, be said to have been kept well within bound here: and Mr. C. G. Dodgson, I. C. S., who relieved Mr. Brooke towards the end of January 1898 for a short time, writes, after visiting the villages of Revdanda, Cheul, and Nagaon :—

“These villages cover a large area, the houses mostly standing well apart from each other in gardens and palm-groves. Wherever a case of plague has occurred, all the neighbouring houses have been evacuated and are now being disinfected.”

While, on the one hand, it is not improbable that this partial evacuation tended to protract the epidemic, a reason for it may, on the other hand, be sought in the fact that the houses were situated under shady palm-groves, which may, as Mr. H. O. Quin, I. C. S.—who had by this time taken charge of the Collectorate from Mr. Dodgson—surmises, have afforded a congenial soil for the location of the plague-germ.

The Nagaon epidemic also began with one case in the week ending 21st January 1898; five cases were registered in the next week, to be followed by eight more after an interval of a fortnight. A plague hospital was erected, the village being rapidly evacuated. To these latter measure perhaps must be ascribed the speedy control of the epidemic. In the first two weeks of March, 7 cases were registered, and in the third week the maximum number attained during the epidemic—14 cases, 9 deaths—was recorded. In two weeks more the outbreak was at an end—long before it subsided at Revdanda and Cheul. This is the more remarkable, because Nagaon is situated close to these villages, and only lengthens the chain of villages forming that group.

Akshi was attacked for the second time in March and April 1898. This village, again, is contiguous to the Revdanda, Cheul and Nagaon group, and it is not, therefore, surprising that the plague, though it did not last here as long as did at either Revdanda or Cheul, owing probably to more thorough evacuation, was yet almost as bad as at those places. The Collector, therefore, redoubled his efforts to free the entire group. Mr. Brooke, who, since the arrival of Mr. Quin, was employed almost exclusively on the supervision of plague measures, the District Deputy Collector, Mr. Guider, and the Plague Mámílatdár, concentrated their efforts: and Mr. Quin himself constantly visited the infected places, inspected and controlled arrangements of his subordinates, and encouraged evacuation as much as possible.

After having been free for a period of nine months, the town of Alibág was, as already mentioned, attacked also for the second time in March 1898, when Mr. S. R. Arthur, I. C. S., succeeded Mr. Quin as Collector. But the outbreak was immediately controlled, the disease having been recognized from the very first, for Mr. Arthur reports :—

“Alibág is newly infected this week. The outbreak was preceded by a mortality among rats, and steps were taken to empty the houses where such mortality was noticed. The first indigenous case occurred in Koliwáda on the 14th instant, when my predecessor ordered the immediate evacuation of the whole quarter and also impressed on the townspeople, generally, the advisability of vacating houses affected by plague last year and camping out in open fields. Large numbers have done this of their own accord, and nearly half the population now live in sheds outside the town.”

From March to June 1898 there were in all 29 cases, all of which unfortunately proved fatal.

Plague had now been established in the Kolába District since November 1896. From that month up to the 10th June 1898, no week had passed without its tale of plague

mortality. But the strenuous efforts of the successive Collectors and their subordinates, aided at last by the people themselves, and marked by prompter and more complete evacuation, by greater influence, and by measures wider in their application and more effective in their operation, were at length rewarded. From the 10th of June 1898, the entire District was practically free from plague. It is significant that just about this time during the previous year there was a subsidence of plague, though not a complete cessation. The following statement gives the monthly figures for the whole District for this epidemic :—

Month.						Cases.	Deaths.
January	1898—4 weeks	...	...	..		90	60
February	„ —4	„	...	...	...	152	121
March	„ —4	„	...	...	...	240	201
April	„ —5	„	...	...	...	108	107
May	„ —4	„	...	...	..	32	28
June	„ —2	„	...	...	..	4	4
Total						626	521

Fourth Epidemic (September 1898—May 1899).—But this welcome immunity was destined to be of short duration : for, in September, plague re-appeared in the villages of Thal and Cheul in the Alibág Taluka. Its origin was importation from Bombay. Rats were affected before human beings at Cheul, and the inmates of the houses where dead rats were found left them of their own accord, and the disease did not develop into an epidemic. At Thal, however, the infection appears to have lain dormant for some time, springing up again into activity towards the end of November 1898.

After an interval of six months, the ill-fated town of Panvel was again attacked (November 1898). As usual, the source of infection eluded discovery, and for the space of a month there were only three sporadic cases. From the middle of November cases occurred regularly every week, though they still continued to be sporadic, and evacuation was very gradual, as only “the parts where the cases have been more than sporadic” were evacuated. But this piecemeal evacuation had little effect in stopping the spread of the disease, though it succeeded in preventing the rapid multiplying of attacks. In January 1899 the whole town, except a part of the southern portion, was infected, and Koliváda and Parit Lane, the most insanitary parts of the town, were then completely evacuated. In other quarters the affected houses and adjoining ones only were cleared.

But among the people that were in camp, clandestine visits to infected houses were not infrequent, and a large proportion of the attacks was contributed by them. To obviate this, the Police staff was strengthened, and greater control exercised over the evicts. “On the occurrence of cases in the fields,” the Collector writes, “a second removal of contacts is being insisted on and the infected hut is either disinfected or burnt.” The southern portion of the town comprising the Máhar Wada was attacked in the week ending 20th January 1899,

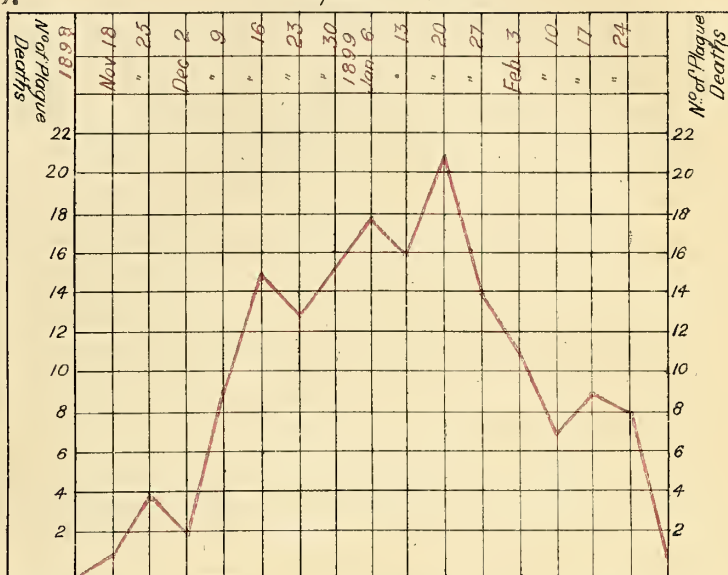
and the people of the Máhár and Chámbhár Wádas were promptly turned out *en masse*. The following week the greater part of the remaining population had left the town, which was now nearly empty, and the results were very satisfactory, as will be seen from the following figures :—

PANVEL TOWN (population, 10,417).

PANVEL TOWN

Population 10,417.

Week ending	Cases.	Deaths.
22nd December 1898...	3	2
9th " " ...	12	9
16th " " ...	14	15
23rd " " ...	13	13
30th " " ...	21	15
6th January 1899 ..	16	18
13th " " ...	17	16
20th " " ...	19	21
27th " " ...	23	14
3rd February " ..	14	11
10th " " ...	8	7
Total ...	160	141



The other places in the District that were badly infected during the *fourth epidemic* were the villages of Vindhane and Taloja and Cheul and Revdanda, particularly the two latter, which during the months of February, March and April 1899, were visited by an epidemic of unusual severity, heightened or perhaps chiefly caused by the obstruction offered by the more influential classes to plague measures of any kind. The effects of these latter were, moreover, often nullified by untimely rain, and by the stealthy visits to infected parts by people who had vacated them. At one time the Collector was obliged to throw all his available resources on these places. In the general decline of plague in May 1899, however, Revdanda and Cheul also participated, though they did not become free until June 1899.

No effort was spared to make inoculation popular. This measure, however, was not introduced till February 1899, and it took some time to convince an unwilling people of its efficacy. In the meanwhile, the epidemic showed unmistakable signs of declining, and there was no urgent necessity for the people to undergo it. Nevertheless, it found some favour at Alibág itself, where 2,150 people were inoculated up to the end of May 1899. Nearly 1,000 more were thus protected at Pen, Revdanda and Cheul, but at Panvel there were only 39 inoculations.

The following statement gives the number of cases and deaths for the *fourth epidemic*, i.e., from September 1898 to May 1899, for the whole District :—

Month.	Cases.	Deaths.
September 1898—3 weeks ...	8	7
October „ —4 „ ...	5	5
November „ —4 „ ...	11	9
December „ —5 „ ...	104	94
January 1899—4 „ ...	134	116
February „ —4 „ ..	198	157
March „ —5 „ ...	235	199
April „ —4 „ ...	224	186
May „ —4 „ ..	172	159
Total ...	1,091	932

As observed in paragraph 6, the Janjira State was affected for three weeks in October 1898, reporting 11 cases and 7 deaths. It was not equally fortunate in 1899. In March the seaport town of Shriwardhan was infected, and though plague ceased there in April, there was a recrudescence in May, and it did not finally leave the town until June 1899. The outbreak was again handled with considerable success by the State Kárbhari. The following is the number of indigenous cases and deaths that occurred there :—

Shriwardhan.
Population—8,800.

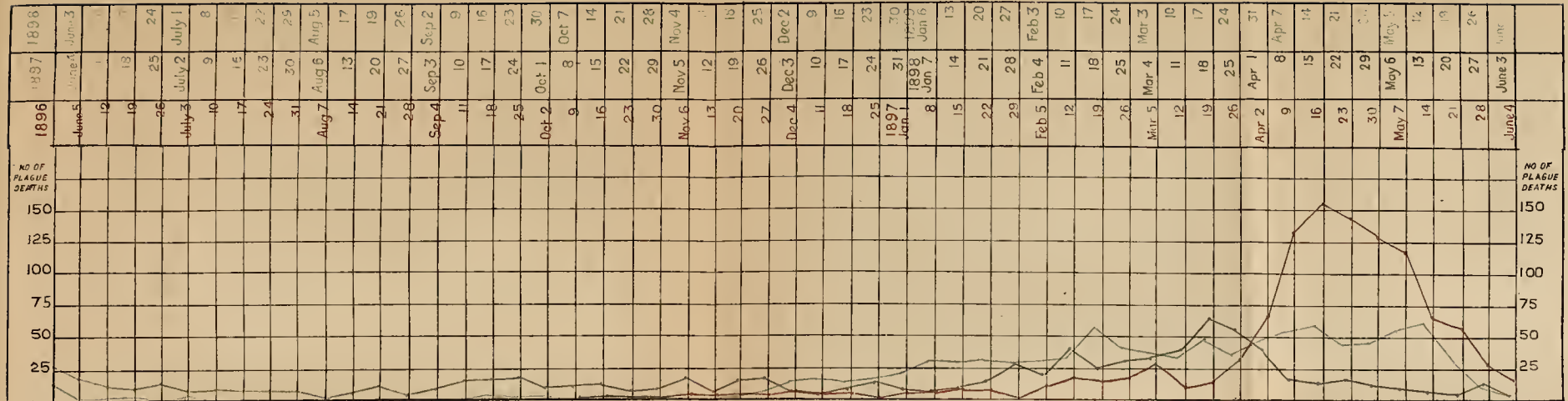
Month.	Cases.	Deaths.
March 1899	7	5
April „ ... ..	...	1
May „	28	21

Since May there has been very slight plague in the Kolába District. The following are the total numbers of cases and deaths from the 3rd June 1899 to the 22nd September 1899, the District being entirely free at present (September 1899) :—

Cases.	Deaths.
43	33

KOLABA DISTRICT.

Chart showing Plague Mortality.



RATNAGIRI DISTRICT.

Area	...	...	...	...	...	...	3,998 sq. miles.
Population in 1891	...	...	...	...	...	...	1,105,926.
Density of population	...	...	...	...	...	...	276·62 per sq. mile.
Rainfall	...	...	...	...	...	...	About 101 inches.

The Ratnágiri District is bounded roughly as follows:—On the north, by the Sávitri river; on the east, by the watershed of the Sahyádri hills from Hátlot to Naradva; on the south-east corner, by the Sávantvádi State coming between Ratnágiri and the Sahyádri hills; and on the west, by the Indian Ocean.

The climate, though moist and relaxing, is on the whole decidedly healthy. The rainfall is abundant and comparatively regular. The climate on the sea coast and for some miles inland is very temperate, extremes of heat and cold being never felt.

The District is well watered by numerous streams and watercourses, which form its very system. Hot springs are found in various parts of the District, the waters of which, as far as taste and smell form any test, seem strongly impregnated with sulphur. The temperature of the water varies in different springs from 100° to almost the boiling point (212°), and at Tural the experiment of poaching an egg has been successfully performed.

Inland, near the trap of the Sahyádri hills, the mali soil is very soft, deep, and dark.

This is the richest soil in the District, and generally holds moisture enough for a second unwatered crop. Pánthal soil is found in low-lying lands, where during the rainy season water lies deep.

There is no authentic record of plague in the Ratnágiri District previous to 1896.*

First Epidemic.—A slight epidemic of plague prevailed in the Ratnagiri District (population, 1,105,926) from the 4th December 1896 to 5th July 1897. The total number of cases was 377 and deaths 316. Of these, however, no less than 241 were imported, leaving only 136 indigenous cases during the 7 months. The last cases of this first epidemic occurred during the week ending 9th July 1897 in the village of Veshwi (in which the disease broke out again in February 1898).

Second Epidemic.—Plague began again on the 10th August 1897 at Burondi. Only 3 cases had previously occurred at this village. These were in April 1897. But the neighbouring villages of Ladghar and Karden were both infected during the months of April and May 1897.

No large town suffered. The following villages were attacked in the order given.

Three fatal cases occurred in April 1897, after which no more plague was reported till 27th August 1897. But the suspicious increase in the mortality leaves room for doubt whether plague had not been in the village for 2 or 3 weeks previously. Mr. K. R. Bomanji, Bo. C. S., the Collector, reports:—

“*Burondi* is a village on the coast in the Dápoli Táluka, about 6 miles south of Harnai. It has a population of 3,183 persons. Taking the death-rate at 40 per mille of the population, the weekly normal rate would be 2·45. In August 1897, from 1st to 26th, there were 52 deaths in the village, all of them, except 7, being reported as due to fever, cough, asthma, or similar diseases. The 7 deaths were from confinement and other causes. At first plague

was not suspected, but on the 27th August 1897 a man was found with a bubo; and plague may be said to have been declared from that time."

The origin is not known. The first case reported was that of a man found with a bubo and fever on the 27th August. As it was the rainy season, it was not possible to erect a regular hospital; and three houses were therefore utilized for this purpose. The patients were kept in these houses, and their relatives and friends in sheds originally erected to shelter boats during the rain—the boats being first removed. The cases occurred in the fishermen's quarter. Owing to the rains the houses were not emptied, but the infected houses were disinfected with carbolic acid and then lime-washed. At the expiration of a month from the last case the segregated people were permitted to return to their houses. No cases occurred subsequent to re-occupation.

The disease did not spread from Burondi to the neighbouring villages, partly owing to the fact that the rains admitted of little intercourse, and even that little was prohibited, the prohibition being supplemented by an observation camp.

The last case occurred on the 15th September 1897. Total number of cases and deaths, 13—11.

This was apparently quite a fresh infection, the origin of which was probably due to

Bánkote.
Population—2,300.

Bombay, as will be seen from the Collector's report, which also details the action taken:—

"*Bánkote* is a village in the Mandangad Petta of the Dápoli Taluka, on the bank of the river Sávariti. Its population is 2,300. On 8th November 1897 a Kunbi boy named Vishram Bábjí Kap got ill and died on the 15th *idem*. This boy was engaged as a servant in the house of a Mahomedan, whose son is a serang in Messrs. Shepherd & Co.'s service. He used to carry the bedding and luggage of persons coming by boat from Bombay and Dásgaon, and probably caught the infection that way. Bankote was infected with plague in April and May 1897. There were 16 cases and 10 deaths. In the last visitation there were 10 cases and 9 deaths. *None of the houses infected in April and May 1897 were affected during the season of 1897-98.* The last case occurred on the 2nd of February 1898.

The hut in which the first case occurred was burnt in the presence of the Assistant Collector, N. D., Mr. Swifte, and the roofs of 20 of the neighbouring thatched houses were removed and houses were disinfected with carbolic acid. The inmates were segregated, and they lived under trees on the top of a neighbouring hill to the south-west.

Rule 29 of the General Plague Rules was made applicable to this village from the 24th November 1897, and all communication between the neighbouring villages was stopped. The first case occurred in the Nadkar Moholla. The people of this and a neighbouring street, Parkar Moholla, were segregated, and they lived in sheds erected by themselves in fields. The sick were kept in a hospital erected for the purpose, and they were visited daily by the Hospital Assistant, who was stationed there since March 1897 for the examination of arrivals from Bombay and other places. The people of Bánkote had great faith in a local Hakim whose treatment they preferred to that of the Hospital Assistant. They were allowed to receive his treatment under instructions from the Plague Commissioner."

A curious point in this outbreak is that although the quarter of the town infected was the same as that which previously suffered, the houses in which cases occurred were all different. The last case occurred on 2nd February 1898, and the people were allowed to re-occupy their houses from the 30th April 1889. No cases occurred after re-occupation.

This village was most probably infected by Bánkote. The history of the first case

Veshwi.
Population—2,382.

and the measures adopted are thus described by the Collector:—

"*Veshwi* is a village in the Mandangad Petta to the east of Bánkote and less than a mile from it. Its population is 2,382. It consists chiefly of Kolis and Dáldis. On 3rd February 1898 a Koli by name Dharmu Hari Ratarkar, aged 45, was attacked with fever. He had a bubo in the left groin. He had not been to any infected area nor was he visited

by any one from any such place. During 1896-97 there were cases of plague in the very same Koliwáda of Veshwi in the months of April and May, and there was plague at Bánkote up to the date of its occurrence in Veshwi in February 1898. There is no room for doubt that Veshwi caught the infection from Bánkote. From April to June 1897 there were 13 cases and 11 deaths in Veshwi. During the season of 1897-98 there were in all 13 cases and 8 deaths.

“On 3rd February 1898, *i.e.*, on the day on which the first case occurred, 134 out of 159 houses of the Koliwáda were vacated and the people went to live in the fields. The remaining 25 houses were vacated the next day. All these 159 houses were disinfected with carbolic acid and perchloride of mercury. As the Nadkar and Parkar Mohallas of Bánkote are close to the Koliwáda of Veshwi, the people of both these Mohallas, who were made to evacuate their houses, were kept in their fields much longer than would otherwise have been done. They resented this very much, and petitioned and telegraphed to His Excellency the Governor in Council. The fact that they escaped so lightly must, I think, be ascribed to the prompt segregation that was resorted to. The Hospital Assistant on plague duty at Bánkote visited the sick daily at Veshwi.”

The work of disinfection was done by the owners of the houses vacated under the direction of men who had been instructed in Bombay. The last case occurred on the 19th February 1898. The people were permitted to re-occupy their houses on the 1st April, and no case has occurred since re-occupation.

Jaigad is a village at the mouth of the Shástri river in the Ratnágiri Taluká. Its population is 3,292. It chiefly consists of Mahomedans, Bhandaris, and Kharwis, and affords an excellent instance of the striking effect of complete evacuation. Attention had been attracted by the excessive mortality during February 1898, but the deaths were all accounted for. On the 28th February, however, the people were examined by a Hospital Assistant, and the existence of plague discovered and declared. The details are interesting, as showing the difficulty Collectors have in finding out the truth in such cases.

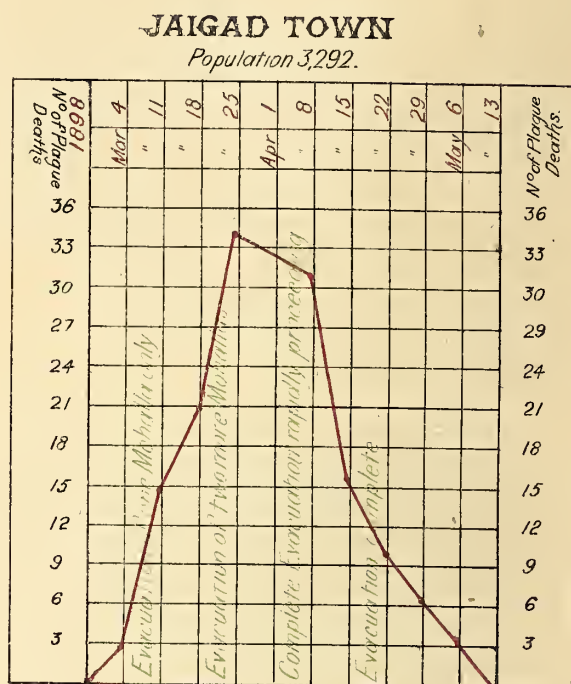
“During the month of February 1898, 50 persons died in this village. The deaths were all ascribed to asthma, dysentery, fever, etc., following the storm and rain of 9th and 10th February last. From the 1st to 11th February there was only 1 death of an old man of 50. From the 11th February to the 18th there were 10 deaths. The Mámlatdár of Ratnágiri happened to be in Jaigad on that day, *i. e.*, 18th February. The usual number of deaths was brought to his notice. He ordered the Head Constable of the Jaigad Post to report if he noticed any further increase. On the 24th February 1898 the Head Constable reported that 25 persons had died, from 19th to 24th February, of the following complaints :—

- 9 persons from chills, said to have been ill for 8 days to 2 months.
- 4 women from confinement.
- 2 persons from asthma.
- 3 persons from bilious disease.
- 3 persons from dysentery.
- 2 persons from colic.
- 1 person from diarrhoea.
- 1 person from debility.

He further added that no one had died of plague. On the 26th February the Mámlatdár sent the report to me, and he ordered a Kárkun to proceed to Jaigad, and wrote to the Chief Constable to send a Head Constable there. His report reached me on the 27th February 1898 at Vengurla. On the same day the Chief Constable was ordered to proceed to Jaigad and get the people examined by the Hospital Assistant in charge of the Tousal detention camp, about 2 miles from Jaigad. The Head Constable had, however, anticipated this order, and on the 28th February the Hospital Assistant examined the people and found 2 persons with buboes, and from that time plague was declared. The source of infection can only be accounted for by the fact that arrivals by steamer from Bombay, reaching Jaigad at 10 P.M., were kept for the night in a dharamshála in the Akbari Mohalla of the village and removed to the detention camp across the river at Tousal in the morning. This dharmashála is very close to the Daldiváda, and that is where the plague began.”

The source of infection was probably, therefore, Bombay. On the 4th March its complete evacuation was begun. On the 8th, Major A. V. Anderson, I. M. S., arrived, and agreed that it was not necessary to vacate the eighth and last Mohalla, seven having been already emptied. Within a month of the completion of evacuation plague had ceased. The following table shows the progress of the disease, week by week :—

Week ending	Cases.	Deaths.
March 4th, 1898...	8	2
„ 11th „ ...	20	15
„ 18th „ ...	25	20
„ 25th „ ...	32	34
April 1st „ ...	40	32
„ 8th „ ...	41	31
„ 15th „ ...	16	16
„ 22nd „ ...	8	10
„ 29th „ ...	7	7
May 6th „ ...	3	3
„ 13th „ ...	1	...
Total ...	201	170



The segregated people lived in sheds, which were supplied free to the poor. The local supply being limited, the materials had to be brought from Málwan and Vengurla. Messrs. Shepherd & Co. kindly transported the *jhámps* used for plague free to any part of the district. These were erected on the top of a hill some 1,000 yards from the village. The vacated houses were twice disinfected with carbolic acid and perchloride of mercury.

The effects of this outbreak were severely felt by the fishermen, who were not allowed to sell fish while in segregation. Their grain-supply was small, and the local Baniyas either left the town or refused credit. The Collector, however, sent for them and persuaded them to advance grain. The healthy males were shortly afterwards permitted to catch fish for food but not for sale. On these hardships being brought to the notice of His Excellency the Governor, he asked Mr. Leslie, the Secretary of the Famine Fund, to send Rs. 300 for the Jaigad and Padwa poor. In all Rs. 178 were allowed for Jaigad, besides a small amount locally raised.

There being no cases amongst the inhabitants of the Ingalwádi and Parkot Mohallas, they were permitted to re-occupy their houses on the 10th May 1898. The remainder gradually returned between the 21st and 25th of the same month. The last case occurred on the 20th May: and none have occurred since re-occupation.

The Collector makes the following comments on the concealment of cases at the beginning of the Jaigad epidemic:—

“Jaigad is unfortunately one of those filthy villages which it is hopeless to save when any epidemic breaks out. The population consists chiefly of Dáldis (Mahomedan fishermen), who are extremely dirty in their habits. At the best of times there is a smell of rotten fish about their houses. The people of this village have paid very dearly for their reluctance to disclose the true state of affairs in time. There can be no doubt now that the place was infected after the 15th February 1898. The Mámlatdár also erred in leaving the village on the 18th February 1898 instead of making a prompt enquiry personally. The disease was however checked in Jaigad proper by the 20th April, the people of Sakri Moholla, which caught the infection last, being the only persons with whom it lingered till the 8th May 1898. The sites of the sheds in which the people lived were constantly being changed as fresh cases occurred, and their clothes and belongings were disinfected frequently. This I think had a good effect.

“Ráo Bahádur K. P. Joshi and Medical Pupil Mr. Torpy deserve great credit for the way in which they discharged their arduous and onerous duties under very trying circumstances. At the best of times Jaigad is a poor place to have to live in, and supplies of any kind were not to be had for love or money, as all communication was cut off. Under such conditions they worked hard and willingly, and their services deserve the appreciation of Government.”

Padwa lies about 4 miles to the north of Jaigad. Its
 inhabitants are mostly Bhandáris and Dáldis (Mahomedans).
 The origin of the pest here is unknown.

“As at Bánkote,” writes the Collector, “as at Jaigad,—so at Padwa the plague began with the Dáldis. The origin was not very clearly traced.” The Collector thinks it probably due to Shriwardhan in the Janjira State, a port at which boats touch *en route* to Padwa: but the Commissioner, S. D., points out the improbability of such a thing, *because no indigenous plague has been known at Shriwardhan*, and thinks that the “infection came either from Jaigad or from some unknown source.”

Whatever may be the true solution of the difficulty, it is certain that on the 3rd April 1898, three days after the arrival of the boat in question, dead rats were found in two houses in Padwa, and on the evening of the same day 9 persons were attacked with plague, all either relatives or friends of the tindal of this very boat. On the 4th April the Collector was at Jaigad. The news of this outbreak reached him the same night, and the following morning he visited Padwa. He found the tindal's relatives had already been moved into sheds by the Máhalkari, and that same day (5th April 1898) the entire Guhagarkar Mohalla was vacated. Nineteen families occupied this Mohalla. Nine of these families were attacked and were removed to sheds, the remaining 10 families living on board their boats.

On the 7th and 8th of April the whole of the town was emptied, the people living in sheds made of *ghamps* and in their boats. The effect of this wholesale evacuation was magical: in the five *days* which had elapsed between the first case and complete evacuation, no less than 29 deaths had occurred. During the five *weeks* which followed it, only 35 deaths occurred, and four weeks after it the disease had practically died out.

Dr. C. T. Parsons, English Doctor, who was stationed at Jaigad, frequently visited Padwa. The following remarks of the Collector are of interest:—

“The Dáldis, I am afraid, are a heartless lot. The healthy members simply refuse to attend to their sick relatives and considerable difficulty was felt on this account. The services of wardboys were necessary, and Surgeon-General sent 7 of them on 25th April 1898. Out of them 3 were sent to Padwa and 4 were kept at Jaigad. All but one man, who is kept at Jaigad, were sent back to Bombay at the end of May last. Most of the segregated persons

in Padwa, a large number consisting of women and children, were poor. These women used to do household work for others in the village and thus maintained themselves. But their occupation was gone, and they had no means of subsistence. They were given grain-doles out of the balance of a fund raised for famine relief last year, and a friend had contributed Rs. 100. But the number of such persons was nearly 200 in Padwa alone, and the balance at my disposal was small. The fact was brought to the notice of Government in the weekly progress report, and, as already stated, I received Rs. 300 from the Indian Famine Charitable Relief Fund at the kind request of His Excellency the Governor. Out of this sum, Rs. 225 were sent to Padwa, and Rs. 169-8-0 were given out of local contribution, *i. e.*, in all Rs. 394-8-0 have been spent from 7th April to 31st August last in feeding the poor. During the rains these people could get no occupation, and they have had to be fed much longer than I had first expected. They have now taken to fishing and other work. On the 23rd of May the people of Padwa were allowed to re-occupy their houses."

The last case occurred on the 4th May 1898, and the people were permitted to re-occupy their houses from 15th May on account of the approach of the monsoon. No case occurred after re-occupation.

Three other villages also reported cases, but either these cases were all imported or for some unknown reason the disease did not develop. In the case of Velás the whole village was evacuated; in the cases of Nandiváda and Bágmandla, the infected quarters only.

The following tables show—

- (i.) the gradual spread from village to village and the population, number of cases and deaths, and source of infection (where known); and
- (ii.) the results of evacuation as shown by Jaigad and Padwa when the number of cases occurring both before and after that measure are compared.

Table showing the order of infection of the villages with the population and the number of cases and deaths.

Village.	Population (Census of 1891).	Date of First Case.	Source of Infection.	TOTAL NUMBER OF	
				Cases.	Deaths.
Burondi	3,183	About 15th August 1897.	Recrudescence [?] ...	13	11
Bánkote	2,300	8th Nov. 1897 ...	Bombay [?] ...	16	10
Veshwi	2,382	3rd Feb. 1898 ...	Bánkote ...	13	8
Jaigad	3,292	About 17th February 1898.	Bombay [?] ...	201	170
Nandiváda ... ..	.....	26th March 1898..	Jaigad	2	2
Padwa	1,800	3rd April 1898 ...	[?]	76	34
Velás	1,278	15th April 1898 ...	{ Bánkote Veshwi }	8	6
Bágmandla	2,786	21st April 1898 ...	{ Bánkote Velás }	4	3
In all 8 villages infected—Total...				333	274

Table showing result of Evacuation on Cases and Deaths in Jaigad and Padwa.

Village.	Date of First Case.	Evacuation complete on	Date of Last Case.	Number of Deaths <i>before</i> evacuation.	Number of Deaths <i>after</i> evacuation.
Jaigad ...	About 17th Feb- ruary 1898.	9th April 1898 ...	20th April 1898 ...	134	36
Padwa ...	3rd April 1898 ...	8th „ „ ...	4th May 1898 ...	29	35

With the exception of a few imported cases, the Ratnágiri District remained free of plague till the end of February 1899.

From February to May 1899 the Ratnágiri District returned 237 and 198 plague cases and deaths, respectively. During June and July the Ratnágiri District was practically free, but suffered from a slight epidemic from the beginning of August to the end of October. The figures from June 1899 to the last week in October for the whole District being :—

Cases, 331—Deaths, 239.

CHAPTER X.

SIND.

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SIND.

Area	46,725 sq. miles.
Population in 1891	2,871,774.
Density of population	61.46 per sq. mile.
Rainfall...	...	...	...	...	2 inches.

The Province of Sind forms the extreme north-western portion of the Bombay Presidency, consisting of the lower valley and the delta of the Indus. It is bounded on the north by Baluchistán, the Punjáb, and Báhawalpur State; on the east by the Native States of Jaisalmer and Jodhpur in Rájputána; on the south by the Rann of Cutch and the Arabian Sea; and on the west by the territories of the Khán of Khelát.

Owing to its prevalent aridity, and the absence of the monsoons, Sind ranks amongst the hottest and most variable climates in India. The thermometer frequently rises in summer to 110° and occasionally to 120°; while in winter it falls at night a few degrees below freezing-point. Although situated on the very verge of either monsoon, the Province derives no benefit from their rainfall; for the north-western monsoon, which deluges the hills of Baluchistán, extends no farther eastward than Karáchi; while the south-western monsoon terminates at Lakhpat Bandar on the boundary of Cutch, as regularly as though it intentionally avoided the frontiers of Sind. Sometimes, indeed, for two or three years in succession, no rain falls in the Province. The climate on the sea-coast, however, is much more equable in temperature than is Upper Sind. In Northern Sind, the extremes of temperature are strongly marked.

The thermometer at Shikárpur often sinks below freezing-point in winter, and ice forms as late as February; yet in summer, for weeks together, the readings at midnight do not fall below 100° F. This great and prolonged heat, coupled with the exhalations arising from the stagnant pools left after the annual inundation, produces a fatal fever and ague.

Although no detailed record of its incidence and spread there is available, yet it is certain that Southern Sind was involved in the great Gujerat Plague Epidemic of 1812-21. Beyond this there does not appear to be any authentic record of plague in Sind previous to 1896.*

Kathiawar excepted, Sind has suffered less severely than any other Division or Agency in the Presidency. With the exception of three bad epidemics in 1896—June 1899. in Karáchi and one of moderate virulence in Hyderabad, plague has been very slight there.

As the system of Camps for the prevention of either importation or exportation of plague was an elaborate one, it has been treated with some prominence.

It is worthy of note that, in spite of successive and severe epidemics, Karáchi City did not very deeply infect the District or very widely disseminate infection. This is in striking contrast to Mándvi, Násik, Poona, Hubli, etc.

There were three important Observation Camps in Sind. The Malir Camp (established 31st March 1898), the most important of them all, was situated near the narrow neck in the hills on the north, through which the North-Western Railway runs. This neck was guarded by a police cordon in touch with the Camp itself. Lieutenant Nibloek, I. M. S., was in charge of it, and made it a most

* *Imperial Gazetteer of India*, Vol. XII.

valuable protection. Between the 31st March 1898 and the 1st July 1898, 9,058 persons passed through it, of whom 126 suffered from plague. Of these 108 came by train from Karáchi (13 with plague on them), and 18 from the surrounding country, who were attempting to escape by road, but were caught by the Police cordon.

The Kiamari Camp was for protection against arrivals by sea ; and suspicious cases found there were taken to Manora. Between the 1st August 1897 and the 31st December 1898, 35,360 incoming passengers were detained, of whom 7 developed plague, and 14,413 outgoing (including 7,103 coolie emigrants to Mombasa) passengers, amongst whom 17 cases were detected. Some arrivals from Bombay threatened a disturbance in this Camp, but Lieutenant Law with firmness and tact succeeded in preventing it.

The Reti Camp (established 19th January 1898) was situated near the Bhawalpur frontier to catch arrivals from the Punjáb. It was under Dr. Adams, and was closed on the 27th June on the cessation of plague in the Punjab. 17,613 persons passed through it, and one plague case direct from Jullundur District was detected there.

Two large Health Camps were established in the desert area beyond the Lyari River. The population of these Camps were about 12,300 and 11,250 approximately. Besides these, the people of the richer classes built camps for themselves of such excellence, and so methodically and carefully superintended, that from the 19th September 1898 people were permitted to leave the city with their sick and without detention in the regular Segregation Camp, provided the sickness was notified. The result was most beneficial. With the dread of the Segregation Camps died the incentive to flee and scatter. It also led to a greatly-to-be-desired result, in that the people, no longer fearful, vacated their houses and went to live outside the city collectively and contentedly. To prevent wrangling, the different communities were separated, and for the very poor some 250 huts (costing 7 or 8 rupees each) were erected.

On the subject of Camps generally, Mr. R. Giles, Acting Commissioner in Sind, writes as follows:--

“The most noticeable features were the Voluntary Camp system described . . . in . . . last year’s report and the maintenance of a strict system of medical examination and detention at the Malir, which saved, in 1898, the rest of Sind from plague.

In the recent outbreak, the Voluntary Camp system was in force from the outset, *i. e.*, the people were permitted to leave with their sick, provided they went into huts outside the inhabited area of Karáchi and only returned to work by day. The results were identical. The sick died or recovered without infecting the newly occupied areas, but those who visited the city, which became, as in the previous year, virulently infected, frequently developed the disease, yet still without its spreading in the Camp.

“This radical measure removes to a great extent the necessity for other plague measures. The Segregation Camp is kept up only for the families of those who will not go out into Camp. Search parties are no longer required, as the majority of people have no occasion to conceal, and in the city disinfection of the houses and inoculation alone remain.

“The most noticeable feature in the third outbreak is the change in the system at the Malir Camp. The Acting Commissioner has, in paragraph 3 of his memorandum on last year’s report, explained how this Camp guards a narrow outlet from Karáchi and renders the protection of Sind comparatively easy. Last year, all arrivals at this neck, whether by rail or road, were examined and detained for 10 days, Government servants and those bearing passes signed by those authorised to grant them being alone permitted to continue their journey.

“This year, the issue of Government Resolution No. 5772-5864-P, dated the 17th October 1898, re-organising the Railway medical inspection and surveillance system, changed the above arrangements and allowed all to pass who could be depended on to report themselves on arrival at destination and to present themselves for medical examination for 10 days subsequently.”

With the exception of a few imported deaths, the Khairpur State remained clear of plague, which was most creditable to the precautions taken by His Highness the Mir's administration. His Highness also considerably offered the services of his Assistant Surgeon when he heard doctors were required in Karáchi, but being the only Medical Officer it was thought better that the Assistant Surgeon should remain where he was in case his services became necessary in the State.

The extent of the plague in the Province of Sind is exhibited in the tables below. In the first epidemic there were 6,063 cases and 4,779 deaths. The population of the Province was returned in 1891 as 2,871,774. During the cholera epidemic of 1892, the three Districts of Karáchi, Hyderabad, and Shikarpur lost 14,659 persons by cholera. Of the number attacked by plague, nearly 79 per cent. succumbed.

In the second epidemic there were 3,675 cases—2,819 deaths.

No other epidemic was reported during this year. Of the 3,675 attacks 76·71 per cent. proved fatal.

In the third epidemic there were 3,063 cases—2,219 deaths. During this year Karáchi Town suffered from a very severe cholera epidemic, the figures for which were 2,295 cases—2,064 deaths. Of the 3,063 attacked by plague, 72·45 per cent. succumbed.

Total Plague Cases and Deaths in the Province of Sind.

FIRST PERIOD.

(From January 1897 to May 1897.)

Locality.								Cases.	Deaths.	Percentage of Deaths to Cases.	REMARKS.
Karáchi City	...	...	...	...	...	...	...	4,181	3,398	81·27	
<i>Karáchi District.</i>											
Tatta	...	...	...	...	...	...	...	53	41	77·36	
Jungsháhi	...	...	...	...	...	...	...	28	17	60·71	
Kotri	...	...	...	...	...	...	...	44	25	56·82	
Other places...	...	...	...	...	...	...	...	113	95	84·07	
Total Karáchi District								238	178	74·79	185 cases—137 deaths imported.
Total Karáchi District, including the City of Karáchi...								4,419	3,576	80·92	
<i>Hyderabad District.</i>											
Hyderabad	...	...	...	...	...	...	...	586	451	76·96	
Tando Alahyár	...	...	...	...	...	...	...	18	15	83·33	
Other places...	...	...	...	...	...	...	...	37	33	89·19	
Total Hyderabad District								641	499	77·85	84 cases—75 deaths imported.
<i>Shikárpur District.</i>											
Shikárpur	...	...	...	...	...	...	...	32	21	65·63	
Sukkur	...	...	...	...	...	...	...	537	391	72·81	
Abad, Táluka Sukkur	...	...	...	...	...	...	...	45	32	71·11	
Rohri	...	...	...	...	...	...	...	151	88	58·28	
Thati, Táluka Rohri	...	...	...	...	...	...	...	50	36	72·00	

Total Plague Cases and Deaths in the Province of Sind—(contd.).

FIRST PERIOD.

(From January 1897 to May 1897.)

Locality.	Cases.	Deaths.	Percentage of Deaths to Cases.	REMARKS.
<i>Shikárpur District—(contd.).</i>				
Miani Raghat, Táluka Rohri	26	15	57·69	
Tando Mir Muhammed Hason, Táluka Rohri	20	16	80·00	
Larkhána	20	14	70·00	
Khairpur Dahirki, Táluka Ubauro... ..	34	24	70·59	
Other places... ..	81	62	76·54	
Total Shikárpur District	996	699	70·18	139 cases—96 deaths imported.
Thar and Párkar District	3*	2*	66·67	* All imported.
Upper Sind Frontier	4†	3†	75·00	† 3 cases—2 deaths imported.
Total for the whole Province of Sind	6,063	4,779	78·82	

SECOND PERIOD.

(From March 1898 to November 1898.)

Locality.	Cases.	Deaths.	Percentage of Deaths to Cases.	REMARKS.
Karáchi City	3,245	2,539	78·24	
Rest of District	430*	280*	65·12	* 402 cases—265 deaths imported from Karáchi City.
Total Karáchi District, including the City of Karáchi	3,675	2,819	76·71	
Hyderabad District ... ..	...	...	...
Shikárpur District ... ..	...	...	...
Thar and Párkar District ... ..	...	...	...
Upper Sind Frontier ... ..	...	...	...
Total for the whole Province of Sind	3,675	2,819	76·71	

THIRD PERIOD.

(From February 1899 to June 1899.)

Locality.	Cases.	Deaths.	Percentage of Deaths to Cases.	REMARKS.
Karáchi City	2,948	2,130	72·26	
Rest of District	45*	36*	72·73	* 41 cases—34 deaths imported from Karáchi City.
Total, Karáchi District, including the City of Karáchi	2,993	2,166	72·37	
<i>Hyderabad District.</i>				
Hyderabad	65	49	...	
Rest of District	5	4	...	
	70	53	75·71	
Shikárpur District ... ..	...	...	...
Thar and Párkar District ... ..	...	...	...
Upper Sind Frontier ... ..	...	...	...
Total for the whole Province of Sind	3,063	2,219	72·45	

HYDERABAD DISTRICT.

Area...	...	...	...	...	...	...	8,271 sq. miles.
Population in 1891	...	...	...	...	...	...	918,646.
Density of population	...	...	...	...	...	...	111·07 per sq. mile.
Rainfall	...	...	...	...	...	...	Average from 6 to 8 inches.

Hyderabad, a vast alluvial plain, 216 miles long by 48 broad, is bounded on the north by Khairpur State; on the east by the Thar and Párkar District; on the south by the same tract and the river Kori; and on the west by the river Indus and Karáchi District.

Fertile along the course of the Indus, which forms its western boundary; it degenerates towards the east into sandy wastes, sparsely populated, and defying cultivation. Considerable variations of climate obtain within the District. In the north, the hot season of April and May is followed by two months of flood, the rest of the year being cold and dry. In the central tract the cold season succeeds the hot without any intervening inundations to graduate the transition; and the change occurs sometimes with such suddenness that, to quote a local saying, 'sunstroke and frost-bite are possible in one and the same day.' In normal years, the District is healthy as compared with other parts of India. Fevers, however, are very prevalent in September and October, when the inundations cease and the canals are drying up; and they last till the northerly winds set in.

There is no authentic record of plague in Hyderabad previous to 1897. The year 1869 is memorable for an outbreak of epidemic cholera, and in Hyderabad Táluka of severe fever.*

The disease appeared in Hyderabad at the beginning of January in imported form, and from the 8th January to the 19th February 33 cases and 28 deaths had been so reported, no week containing double figures in either cases or deaths. Hyderabad, like Karáchi, is a closely-packed old town with numberless narrow lanes and blind alleys. Its situation on a hill, and its dry climate—both, doubtless, unfavourable to the germ—probably prevented the serious development of the epidemic.

On account of the large number of imported cases, Mr. C. G. Dodgson, I. C. S., the Collector, made Hyderabad his head-quarters. He insisted on house-to-house inspection being made a reality, and on the removal of patients, when their condition permitted, to sheds; and on the 23rd of February proceeded to take action in person by causing the evacuation of a group of houses containing about a hundred families where the epidemic was increasing.

On the 3rd March it was evident that plague had broken out in Hyderabad and medical inspection on the Railway was commenced in view of a probable exodus. Sixteen medical students were placed on the main roads leading out of Hyderabad, and it became difficult for any sick person to get away.

Large numbers of dead rats discovered in the houses when opened for disinfection and cleansing proved the wisdom of removing the inmates of houses, which, though not actually infected themselves, were yet in proximity to such houses as were. Mr. R. Knight, I. C. S.,

* *Imperial Gazetteer of India*, Vol. V.

the Judge, and a strong body of volunteers, amongst them Mr. M. Hesketh, Principal of the Sind College, and Mr. Dayaram Gidumal, the Judge of Shikárpur in Hyderabad, ably assisted Mr. Dodgson in his fight with the plague.

Mr. Dayaram Gidumal established a Private Hospital on the Native Library premises under the Reverend A. Canney, C. M. S., and Miss Piggott, Z. M., of which Lieutenant-Colonel Hume Henderson, I. M. S., held general medical supervision.

On the 24th of March the Government High School was opened as a Plague Hospital under Lieut.-Colonel Hume Henderson and a staff of Lady Nurses from Calcutta. Both Hospitals were closed on the 15th of June 1897.

Apart from Hyderabad itself, 55 cases and 48 deaths occurred in the District, of which 18 cases and 15 deaths occurred at Tando Alahyár.

But in spite of all efforts the epidemic grew, spread in every direction by fleeing victims, and with the week ending 9th April 1897 threatened to become severe. Mr. Dodgson broke down under the strain and was compelled reluctantly to take furlough. His last act was to recommend a Plague Committee, and one was constituted under the orders of Government on the 9th April 1897. This Committee did good work, minimising correspondence and promoting united effort. The Camps, carefully laid out and systematically worked by Captain Cater Jones, were brought under the control of European non-commissioned officers and soldiers.

Towards the middle of April the disease, owing probably to the exodus of the healthy, rapidly subsided, and the last case occurred on the 2nd of June; 23,000 persons had passed through the disinfecting depôts. The weekly figures for this first epidemic are given in the Chapter on Sind as a whole. From June 1897 to March 1899 the Hyderabad District was free from plague, 2 imported cases (1 fatal) occurring throughout this period at Hyderabad Town.

From March to June 1899 a few cases occurred in the town, the following being the figures:—

Week ending						Hyderabad Town.		Rest of the District.	
						Cases.	Deaths.	Cases.	Deaths.
10th March 1899	...	...	...	...	...	2	2	...	...
19th "	"	...	...	...	...	...	...	...	...
24th "	"	...	...	...	...	...	...	...	...
31st "	"	...	...	...	...	4	1	...	...
7th April	"	...	...	...	...	5	5	...	...
14th "	"	...	...	...	...	3	...	1	1
21st "	"	...	...	...	...	3	4	...	...
28th "	"	...	...	...	...	12	6	...	...
5th May	"	...	...	...	...	20	16	...	...
12th "	"	...	...	...	...	11	11	3	2
19th "	"	...	...	...	...	3	3	1	1
26th "	"	...	...	...	...	2	1	...	...
Total...						65	49	5	4

Since June 1899 Hyderabad Town has suffered from an epidemic which began in the week 11th—18th August, the average number of cases being about 70 weekly. The total number from 18th August to 27th October was 844 cases—716 deaths for the whole District. Husree village was also affected, but the infection spread no further.

KARACHI DISTRICT.

Area	...	...	...	...	...	14,303 sq. miles.
Population in 1891	...	...	...	...	...	564,880.
Density of population	...	...	...	...	...	39.49 per sq. mile.
Rainfall	...	...	...	...	...	5 inches.

Karachi District is bounded on the north by Shikárpur; on the east, by the Indus and
 Boundaries. Hyderabad; on the south, by the Arabian Sea; and on the west,
 by Baluchistán.

The climate of Karachi City and the neighbouring country, which is in every direction
 Climate and natural features. open to the sea-breeze, possesses a great superiority to that
 which prevails throughout the remainder of Sind. The hill-
 country of Kohistán is also cooler in Summer and warmer in Winter than is the case in the
 plains. In the north, on the other hand, near the barren Laki range of hills, the heat often
 becomes insupportable. The hot season commences about the middle or end of March, reaches
 its maximum in the month of July, and lasts till the end of August, when the temperature
 once more becomes tolerably cool. Karachi City is said to enjoy the healthiest climate in all
 Sind.

Previous epidemics. There is no authentic record of plague in Karachi previous
 to 1896.*

First Epidemic. (December 1896—May 1897).—The first case of plague reported in
 Karachi City. Karachi City was that of a Brahman cook, 16 years old, who was
 taken ill on the 4th December 1896 and died on the 9th. Three
 more cases were reported on the 11th, and on the 19th plague was declared epidemic.
 Although plague, therefore, must have existed in Karachi from the beginning of December,
 the Acting Commissioner in Sind draws attention to the fact that the mortality during
 October, November, and December, taken either daily, weekly, or monthly, gives no
 indication of its presence. He also points out that the usual imported cases are wanting
 in the history of the introduction of plague into Karachi: nor is there any record of an
 abnormal mortality amongst rats. The origin of the disease in Karachi, therefore, remains
 wrapped in mystery.

The locality first attacked was the old town quarter. Up to the end of December, out
 of 63 cases (59 fatal), 51 occurred there.

On the 25th December Lieutenant-Colonel J. W. Clarkson, Sanitary Commissioner for
 the Government of Bombay, addressed the Acting Commissioner, strongly recommending
 compulsory segregation of the sick; and to ensure this, and also prompt information of
 sickness, the Acting Commissioner issued orders to all District Officers calling for daily
 reports from any place where plague appeared, and directing compulsory segregation of
 patients. Meanwhile in Karachi cleaning and disinfection were being energetically carried
 out by the Municipal Executive; and suitable houses were set apart as Caste Hospitals for
 such patients as did not possess suitable private dwellings, and, by a resolution of the Muni-
 cipality, compulsory segregation was limited to those patients who, in the opinion of the
 Health Officer, had no proper segregation accommodation.

* *Imperial Gazetteer of India*, Vol. V.

On the 3rd January the Acting Commissioner, in order to ascertain how far the Municipality were in a position to carry their resolutions regarding segregation, disinfection, and notification of sickness into effect, returned to Karáchi, and on the same day, accompanied by Colonel G. G. Bainbridge, P. M. O., Mr. R. Giles, the Collector, Lieutenant-Colonel W. G. H. Henderson, Captain H. C. L. Arnim, Deputy Sanitary Commissioner, and Dr. S. M. Kaka, Health Officer, made a tour of inspection through the City and found that the Municipality had not been misrepresented. The disinfection of rooms in which deaths had occurred was most thorough, and to Dr. Kaka is due the credit of the use of perchloride of mercury as a disinfectant throughout the operations.

But the buildings reserved as Caste Hospitals were empty; and it was clear that only force would fill them. To such means, however, without first trying gentler methods, the Acting Commissioner was unwilling to resort; and he consequently refused his sanction to compulsory removal. Lieutenant-Colonel Clarkson now put forward a valuable suggestion. This was to divide the City into Wards or Districts, with a Medical Officer attached to each for inspection of cases, and an Inspector to discover and report them; a suggestion which was at once acted on. These measures were soon justified by their success.

The Hindus, no longer fearful of measures of which they neither understood the value nor perceived the use, gradually accepted both treatment and segregation. The Collector had meetings with the Mahomedans, and gave them four Lady Doctors, and Mahomedan Physicians, thus gradually gaining their acquiescence to these measures. Only one instance of resistance to authority is on record. It arose from the necessity of disinfecting a house and burning down a hut, and occurred on the 18th of January amongst the fisher class, a class who had on previous occasions of epidemic disease proved troublesome.

Under instructions from Government, Railway Medical Inspection was instituted on lines laid down by the Principal Medical Officer from the 1st January 1897. But a serious exodus, arising from the declaration of epidemic plague, greatly accentuated the danger of dissemination, and from the 8th January, therefore, measures for the control of arrivals and departures were adopted and gradually developed. Civil Surgeons and Hospital Assistants were responsible for the inspection of travellers at Karáchi and all the chief Railway Stations in Sind. On the 10th detailed orders were issued to each District Officer, directing him to superintend the arrangements obtaining in his District and to take immediate action to supplement and otherwise aid this organization where necessary. From the 14th January inspections of both Up and Down trains were held at the following Stations: Kotri, Laki, Dadu, Hyderabad, Pad Eidan, Rak, Jacobabad, Shikárpur, Sukkur Rohri, and Reti, and on the 23rd January the Acting Commissioner reported that the Railway Medical Inspection throughout the Province was careful and thorough. As the exodus increased, Commissioned Medical Officers were asked for, and on the 15th February Lieutenants N. B. J. Rainier and A. Gwyther took over charge, the former at Karáchi and the latter at Dadu Railway Stations.

As the epidemic grew, the people deserted the infected quarter, fleeing by rail and road and sea; even those who remained in the town fled to the houses of their neighbours or their friends. To cope with this, a special Police organization was required, and the District Superintendent of Police, Mr. C. McIver, abandoning his tour at the request of the Collector, formed, in conjunction with the General Officer Commanding, a Police and Military Cordon between the City on one side and the Sadar Bazár Cantonments on the other.

The construction of Health Camps was now taken in hand, and Mr. J. Strachan, Engineer and Secretary to the Municipality, rapidly erected huts on a site across the river, into which the Collector endeavoured to get the Hindus of the old town to move. Eventually, with some concessions to the people, this was done, and proved a useful example.

The increasing daily mortality at length induced the Acting Commissioner to relinquish the rest of his tour, and on the 23rd of January 1897 he returned to Karachi to find this first Health Camp just occupied by some 2,000 Nasurpuris. It was laid out, with water-pipes, bathing platforms, &c., nor had the Municipality spared expense to make it attractive.

On the 26th January Surgeon-General J. Cleghorn, Sanitary Commissioner to the Government of India, arrived to examine the measures taken. Mr. P. R. Cadell, I.C.S., was summoned to Karachi, in order that the work might be in the charge of responsible Officers; and on the 30th January the infected portions of the town were divided between Messrs. Cadell and H. S. Lawrence and Inspector Brown, each with a separate Sanitary establishment and Subordinate Staff. The Judges, Messrs. T. Hart-Davies and J. C. Gloster, also joined in executive work and produced an excellent effect.

February opened with an increase; the numbers on the 1st, 2nd, and 3rd being 59, 49, and 56, respectively, the highest daily totals recorded. These high figures were largely due to the Trans-Lyari quarter (population, 30,000) which had become infected on the 10th January, and up to this had not suffered severely, but which now called for special action. Sardár Khán Bahádúr Mahomed Yakub was accordingly placed in charge of it, with Khán Sáheb Rasul Bakhsh as Assistant, and a few Muhammadan supervisors; but it was not until the 19th of March that the Trans-Lyari Muhammadans consented to move their sick. On that date they moved them all out together, and from that time the difficulties in isolating the sick there ceased.

The Civil Hospital became a Plague Hospital, and the Government High School was a Civil Hospital, of which Lieutenant W. J. Niblock, I. M. S., ultimately assumed charge. The Convent Sisters, under Sister Heriberta, also came forward, taking up, with the consent of the Reverend H. Jürgens, their abode in the Plague Hospital for several months, tending the sick day and night. Later on they were assisted by the Misses Carey of the Zenana Mission and some nurses who were paid from the Charitable Fund. The origin of this fund deserves notice.

The Pleaders and other native gentlemen were desirous of giving a farewell entertainment to Mr. Hart-Davies on his retirement. But Mr. Davies begged that the money might be devoted to some public object. A meeting was called at Government House, and it was decided to raise a charitable fund of which this money should be the nucleus. It was augmented by a Concert given by the ladies of the Station, and by private subscription, and ultimately amounted to Rs. 20,000. This fund was given piece-meal to Superintendents, and was used for furniture for Hospitals, food, stimulants, &c.

The Jail had one case in spite of every precaution. It was that of a prisoner of 5 months' standing; the infection may have come from a Warder. No other case occurred. As it is in the heart of the town, and was for long encircled by plague, the Jail may be considered a striking instance of segregation.

On the 20th March His Excellency the Governor visited Karachi, and, after inspecting all that had been done, appointed a Plague Committee there. It consisted of—

President—Major-General T. A. Cooke, Commanding Sind District.

Members— $\left\{ \begin{array}{l} \text{Mr. R. Giles, Collector.} \\ \text{Captain H. C. L. Arnim, Deputy Sanitary Commissioner.} \\ \text{Mr. J. Strachan, Municipal Engineer.} \end{array} \right.$

General Cooke at once threw himself energetically into the work, and on the 25th March the first Military search party went out. All apprehension was soon allayed as to the result, for from first to last not a complaint was ever preferred.

A slight decrease from February's figures was observable in March, and from the middle of April the epidemic rapidly subsided.

The following are the plague figures, week by week, in Karáchi:—

Plague Deaths.				Plague Deaths.			
Week ending	10th Dec. 1896	...	1	Week ending	25th Mar. 1897	...	188
"	17th " "	...	9	"	1st April " "	...	192
"	24th " "	...	21	"	8th " "	...	172
"	31st " "	...	28	"	15th " "	...	115
"	7th Jan. 1897	...	103	"	22nd " "	...	127
"	14th " "	...	159	"	29th " "	...	86
"	21st " "	...	200	"	6th May " "	...	65
"	28th " "	...	181	"	13th " "	...	52
"	4th Feb. " "	...	295	"	20th " "	...	23
"	11th " "	...	262	"	27th " "	...	20
"	18th " "	...	239	"	3rd June " "	...	29
"	25th " "	...	217	"	10th " "	...	7
"	4th Mar. " "	...	197	"	17th " "	...	1
"	11th " "	...	207	"	24th " "	...	2
"	18th " "	...	189				

In the Karáchi District itself, outside of the City, only 238 cases and 178 deaths from plague occurred in all. Of these, only 53 and 41 were local cases and deaths. The disease only took root in Tatta, with which its Karáchi District. Railway Station Jungshahi must be included, and in Kotri. Tatta is a town of about 10,000 inhabitants, about 13 miles from Jungshahi. It is a favourite resort of the upper classes of Karáchi, and is on the main route to Cutch. From the middle of December to the week ending the 19th February, 31 cases and 21 deaths, all imported, had occurred in Tatta. The influx then appears to have ceased, and no more deaths were reported till plague broke out locally in the week ending the 26th March. Thereafter the outbreak was local, and practically ceased early in May.

Second Epidemic (April 1898—August 1898).—The cause of the second outbreak is obscure. Karáchi was declared free from August 1897. On the 28th March 1898 a case occurred, and on the 31st another. But the City was prepared. The former Plague Committee, with General Cooke at its head, had never been dissolved, and immediately set itself to organize measures to combat the disease. The measures in force during the second epidemic differed in two essential, and several minor, respects from those which had been employed during the first: (1) Widely extended compulsory evacuation; (2) An improved system of voluntary evacuation, known as "voluntary camps." Inoculation on a small scale, disinfection under English Medical officers, &c., were amongst the minor contrasts. The Plague Committee was composed of—

President—Major-General T. A. Cooke, Commanding Sind District.

Members— $\left\{ \begin{array}{l} \text{Mr. R. Giles, Acting Commissioner in Sind.} \\ \text{Lieut.-Colonel J. McCloghry, I. M. S., Civil Surgeon.} \\ \text{Mr. J. F. Brunton, Acting Secretary and Engineer to the Municipality.} \end{array} \right.$

The first measure was the organization of Superintendents (with staff for each). Passes were introduced which were at first given to persons living in uninfected portions of the town, but were afterwards restricted to persons who had completed ten days' residence in the Malir Camp.

(1) Inoculation.—This was begun on the 13th of April 1898, and extended over 3 months, the last operation being performed on the 19th July 1898. The total number of inoculations was 6,106 ; 3,911 being males and 2,195 females. The results up to the 25th August were as follows:—Among the 287 twice-inoculated neither case nor death occurred. Among the 5,819 once-inoculated there were 44 cases and 25 deaths, of which 14 cases, 10 deaths occurred within ten days of the operation.

(2) Structural improvements.—A large number of structural improvements, carried out by the influence of the Plague Superintendents, were particularly noticeable when the Acting Commissioner accompanied the Plague Commissioners on a tour of inspection through Karáchi City on the 25th of January 1899.

(3) The Relief Fund, ably managed as before by Mr. Motiram Advani.

(4) The opening of the grain shops, when the regular shops were closed, by Ráo Bahádur Vishindas Nihalchand, who, as in the previous epidemic, maintained an excellent Private Hospital at his own expense.

(5) Dr. Simond's visit between 9th May and 6th June 1898 in order to test the efficacy of Dr. Roux's serum. Dr. Simond operated on 75 persons, of whom 37 died, 31 recovered, and 7 remained under treatment.

The following are the figures, week by week, of the epidemic from the 31st March 1898 to the 2nd September 1898—

Week ending	Municipal limits of Karáchi.		Week ending	Municipal limits of Karáchi.	
	Cases.	Deaths.		Cases.	Deaths.
23rd March 1898	8	...	1st to 3rd June 1898	72	55
8th April "	20	13	10th June 1898	144	101
15th " "	76	52	17th " "	91	74
22nd " "	179	131	24th " "	47	34
29th " "	314	221	1st July "	31	22
6th May "	597	496	8th " "	19	14
13th " "	656*	528	15th " "	11	9
20th " "	408	367	22nd " "	21	17
27th " "	280	207	29th " "	23	19
31st " "	124	97	5th Aug. "	19	15
			12th " "	14	11
			19th " "	9	5
			26th " "	19	10
Total from 23rd March to 31st May 1898	2,662	2,112	2nd Sept "	9	5

* 51 of these occurred previously.

Third Epidemic (February 1899--June 1899).--Yet a third epidemic occurred in Karáchi during the current year.

A long series of dropping, or sporadic, cases occurred between the cessation of the second epidemic and the commencement of the third. No single week, indeed, throughout this interval passed without plague being returned. Of this period Mr. Sladen, the Acting Collector, gives the following interesting account:--

"The course of the plague subsequent to the re-occupation of the town after the second epidemic will now be briefly traced.

"At the end of July, the epidemic was lingering on in the Ranohor and Sadar Bazaar Quarters, at Kiamari, in the Lyari Quarter and the Trans-Lyari Camps.

"In the Ranohor Quarter, six cases occurred in a fresh center, in a compound inhabited by inoculated persons, towards the end of July. After an interval, plague broke out among the sweepers, who up till then had been comparatively free, and this was followed a fortnight later by a sharp outbreak among the sweepers at Kiamari. Finally, in the middle of September, there was another revival among the Katchis in the Ranohor Quarter. About 300 persons were then segregated, among whom a few cases appeared, and about 10 days later, as fresh cases occurred in the same quarter, a large block was evacuated and kept vacant for about 6 weeks. The quarter then remained free, except for a solitary case in October, from 29th September to 2nd March 1899. At Kiamari, plague died slowly and caused some anxiety, as it continued through the busy export season with a few cases every week. Then after a brief interval occurred an outbreak among the sweepers, which was severe, but was quickly stopped by evacuation.

"In the main portion of the Lyari Quarter, the plague died away rapidly in June and disappeared in July. In an isolated corner of the quarter, called Dhobi Ghat, plague unexpectedly broke out at the end of July among Mekranis, Banias, and others; but fortunately did not affect the dhobis. The affected area was evacuated immediately and no further cases occurred except in segregation.

"In the Voluntary Camp area, a few cases occurred in July, and early in August a Mekrani village took infection from Kiamari.

"In the middle of August, plague appeared in a little cluster of huts in the gardens, known as Tharu Lines, inhabited by Lasis. It is on the bank of the Lyari, and several families suddenly crossed and camped on the other side. Six cases occurred here. The whole village was evacuated and cleaned and kept empty for 2 months.

"On the 17th October, plague appeared in another small community in the gardens, the owners of the gardens being Khojas and their servants Katchis.

* * * *

"To go back to the Sadar Bazaar. After 21 cases and 15 cases in the first two weeks of June, the plague fell to about 5 cases a week: it seemed to disappear and again revive. Several cases occurred among the Mochis early in August, then followed a respite of several days, and it again broke out among the Mochis in the middle of September. This time Mr. Brayson, Deputy Collector, who was in charge, had the whole Mochi Quarter vacated and insisted on the ground floors being paved before the residents returned. This had the desired effect at the time, but it did not prevent the plague breaking out among the same community this year. From the Mochis the infection seems to have been spread by rats to neighbouring houses. The rats were very numerous in the Sadar Bazaar and Civil Lines, and a few were occasionally found dead in the former quarter. Infection conveyed by rats seemed the most probable cause of a case in a Memon compound not far removed from the Mochis' houses.

"On the 4th October a Memon girl in Rambagh developed plague who was found to have slept 2 nights with friends in the Sadar Bazaar. Although this and the neighbouring 2 or 3 houses were vacated at once, the infection had already spread, and in the next three weeks there were 7 cases among the Rambagh Memons in this neighbourhood, and one Hindustani child appears to have caught it from playing with them.

"Meanwhile, sporadic cases were occurring in other parts of the town, the victims being widely dissociated. The last of these, however, occurred early in November, and once for a period of ten days and on another occasion for eight days in succession no cases were reported. The infection among the Rambagh Memon community was stopped by evacuation and segregation in the special Memon Camp early in November.

"Infection next appeared among other Memons in the Garden Quarter, about half a mile away, where it adjoins the town proper, about which the following extract from the weekly Plague report is quoted:—

'During the past fortnight or three weeks, five deaths occurred in a large compound in the Garden Quarter. The bodies were examined in every case, but except that the deaths were considered suspicious by reason of their occurring partly among the members of the same family in adjoining rooms and so soon after one another, there was no reason to believe them to be due to plague. * * * A true case has now occurred among them 7 days after the last death.'

"This case was followed by 5 others from the same source of infection, most of them occurring in a camp to which over 600 persons were removed from their houses after the first case mentioned above. On December 1st, a Bhil girl in a neighbouring compound died of plague, and on December 21st and 22nd two Memon children of another compound. The weekly report is again quoted regarding these two cases, as the difficulty in diagnosing deaths from plague was again exemplified:—

'On the 12th a Memon woman died after giving birth to a child on the 11th, who also died. It was certified after examination that there were no symptoms of plague. On the 17th, a Memon 50 years old died and was certified not to have died of plague by the doctor who attended him. He had been living in the house next to that in which the woman had died on the 12th. The two cases this week are the son, aged 12, and the grandson, aged 2½, of the man who died on the 17th.'

"In the following week, one more case occurred traceable to this source, and later on another. It broke out next in a compound in the Jail Quarter close to those from which the residents had been removed to camp. Four cases occurred on the 8th, 9th, 10th, and 12th January, a fifth on the 18th, and with them the plague ceased in this neighbourhood for a time.

"In the weekly reports, attention has been drawn to the large proportion of children who suffered during the epidemic among the Memons. Out of the 3 cases in the Rambagh Quarter, 7 were children under 14 years, and 6 of the 14 cases from the Garden and Jail Quarters which occurred in November, December, and January.

"This completes the narrative of the intermediate months between the second and third epidemics. The last cases of the second epidemic were succeeded by a series of small outbreaks quickly subdued, and sporadic cases among all classes. When the rest of the town was free, there followed the outbreak among the Memons, the insidious spread of which to the Garden and Jail Quarters was not checked until the middle of January."

The third outbreak in Karachi was probably a recrudescence. "No possible cause except recrudescence," writes Mr. Sladen, "could be assigned for the first of these cases. The second might, perhaps, have been derived from the first, but no connection was traceable. From the 28th of January, when the first case occurred in the Napier Quarter, it was evident that a recurrence of plague in an epidemic form was probable."

Throughout February the cases gradually became more numerous; while throughout March the figures rose rapidly. Mr. Sladen thus briefly reviews the progress of the epidemic:—

"From the 26th February, there was a rapid increase in the number of cases, and the totals of the succeeding weeks rose steadily from 59 in the week ending March 3rd to 428 in the week ending April 14th. Plague mortality began to decline at once after the maximum had been reached, but the figures remained high till about May 10th, when the improvement became very rapid. The total number of cases in the weeks ending May 26th and June 2nd were only 29 and 34, respectively, and in the week ending June 23rd there were none. The succeeding weeks have shewn one or two cases only. As an epidemic, plague was practically over by the end of May."

It is worthy of note that during this epidemic the plague mortality amongst males was far greater than amongst females; that amongst children being comparatively insignificant. The subjoined statement compares the figures for each of these classes:—

				Adults.		Children.
				Males.	Females.	
February—						
Cases	...	...	...	55	17	3
Deaths	...	...	...	42	11	...
March—						
Cases	...	...	...	585	175	33
Deaths	...	...	...	384	117	25
April—						
Cases	...	...	...	928	500	80
Deaths	...	...	...	668	370	62
May—						
Cases	...	...	...	359	183	46
Deaths	...	...	...	268	153	42

The infection appears to have visited every part of the city.

As regards the measures taken to meet it, the following were the most prominent:—

- (1) Health, Observation and Segregation Camps.
- (2) Evacuation.
- (3) Disinfection.

The Camps, with their objects, have been previously described. They were established at Malir, Kiamari, Jati (for arrivals from Cutch) in the District; and at Translyari, at Lyari, at Tatta Naka and at Thul, in the city itself.

Most of these Camps had stood in each epidemic, and served their various purposes with considerable success; it is only necessary to dwell here, therefore, upon the modifications of their working during 1898-99. The chief modification was that introduced throughout the whole Presidency in November 1898, when detention was abolished and surveillance was introduced.

The following remarks on the City Camps and on Evacuation by Mr. Sladen are full of interest:—

“In the Camps, 413 cases and 299 deaths occurred between 21st February and 31st May. The numbers seem large, but it has to be remembered that all persons are included who were not actually known to have plague when they left the town, and a very large percentage of the cases occurred within a few days of the arrival in Camp. Last year, all cases that developed within 10 days after leaving the town were entered as cases in the town. Latterly, when the bulk of the people had left the town and cases continued to occur, very careful enquiries were made, with the invariable result that the person attacked was found to be either a regular visitor to the infected part of the town or more often had stopped the night or till very late in the evening at a house or shop instead of coming back to Camp. Cases attributable to personal contact in the Camps were very rare, and in no cases was there reason to suspect local infection. Mr. Motumal writes that, generally speaking, those who died in his division were Chaprus, Mekranis and low class Katchis, who found employment sewing gunny bags and working as coolies at Kiamari or in godowns in the city. Plague among high-caste persons was exceptional, although they went daily to Karáchi to their offices.”

Generally speaking, no one developed the disease in Camp, unless he had brought the infection on him from the town. The advantages of leaving infected sites for fresh ground are too well known to need repetition.

The evacuation of blocks had no appreciable effect on the spread of plague when once the epidemic had begun, though it may be reasonably assumed that it minimised the mortality. It was probably the chief means of stopping the local outbreaks among the Memons in November 1898 in the Rambagh Quarter and in the Garden Quarter. It has yet to be discovered what law governs the progress of infection when once an epidemic begins. While it is known that houses when infected are most dangerous, it cannot be said that the interiors of houses are the only places where the germ is found.

The open country in the immediate neighbourhood of Karáchi is peculiarly suitable for Camp sites within reasonable distance of the town. The water-supply is fair, though, owing to the failure of the rain, it was not so good this year as last.

The provision of huts entails considerable expense to the poorer members of the community, who are, however, often generously assisted by the wealthier members. The provision of materials for the indigent formed a large portion of the expenditure during the last plague.

One weak point in the system followed in Karáchi was that infected articles were removed to the jungles without hinderance, the actual rubbish and infected bedding only in the vacated houses being destroyed. The excellent results that have always followed evacuation, coupled with thorough disinfection and subsequent segregation, are well known. But on the other hand the rapid cessation of plague in the Camps point to a comparatively small risk from infected clothing: the benefit of wholesale disinfection on evacuation, even if it were feasible, would be lessened by the daily return to work in the infected locality; and the dislocation of business which follows absolute segregation and the comparatively small risk run by working by day in infected areas render it inadvisable to attempt to carry out on a large scale the plan followed with such success with small numbers.

The difficulty of preventing persons who have vacated their houses for Camp from returning to the town to reside in other houses is another weak point in the system. The Police were warned which houses had been evacuated, and persons were detected at times in the earlier part of the epidemic residing in them. In the Nasarpuri and Khatri Camps in the town, where the huts were all numbered, a regular roll-call was attempted; but such a system would be out of the question in the Voluntary Camp area—entailing an establishment which would be very expensive and an amount of interference and supervision which would be much resented.

The danger of harbouring contacts and of living in infected premises are both fairly well understood, and the good sense of the people is the best safeguard against an abuse of the freedom enjoyed in the Voluntary Camp area. The arrangements offered for the safe custody of valuables in the Police Strong Room when families removed to Camp was not taken advantage of to any extent either last year or this year. Large quantities of valuable ornaments were kept in the mat huts in the Camps, and there were not many who took the precaution even of burying them in the ground. One or two serious thefts took place in consequence.

The following were the figures for the third epidemic:—

Week ending	Karachi City.		Villages in Karachi Taluka outside Karachi Municipal limits.					
			Imported from Karachi.		Indigenous.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
3rd March 1899	59	35	...	...	...	...	...	...
10th " "	88	58	2	1	...	...	2	1
17th " "	139	103	2	2	...	...	2	2
24th " "	217	140	3	2	...	...	3	2
31st " "	316	207	5	4	...	...	5	4
7th April " "	356	278	5	2	...	...	5	2
14th " "	428	275	6	4	...	...	6	4
21st " "	361	281	3	3	...	...	3	3
28th " "	275	207	2	2	...	...	2	2
5th May " "	276	208	...	1	...	...	...	1
12th " "	254	181	6	5	...	...	6	5
19th " "	87	96	6	6	3	1	9	7
26th " "	30	19	...	1	1	1	1	2
27th to 31st May 1899	30	19	...	...	...	...	...	...
Total from 1st December 1898 to 31st May 1899	2,995	2,164	41	34	4	2	45	36
Grand Total from 1st June 1898 to 31st May 1899	3,578	2,591	59	49	13	8	72	57

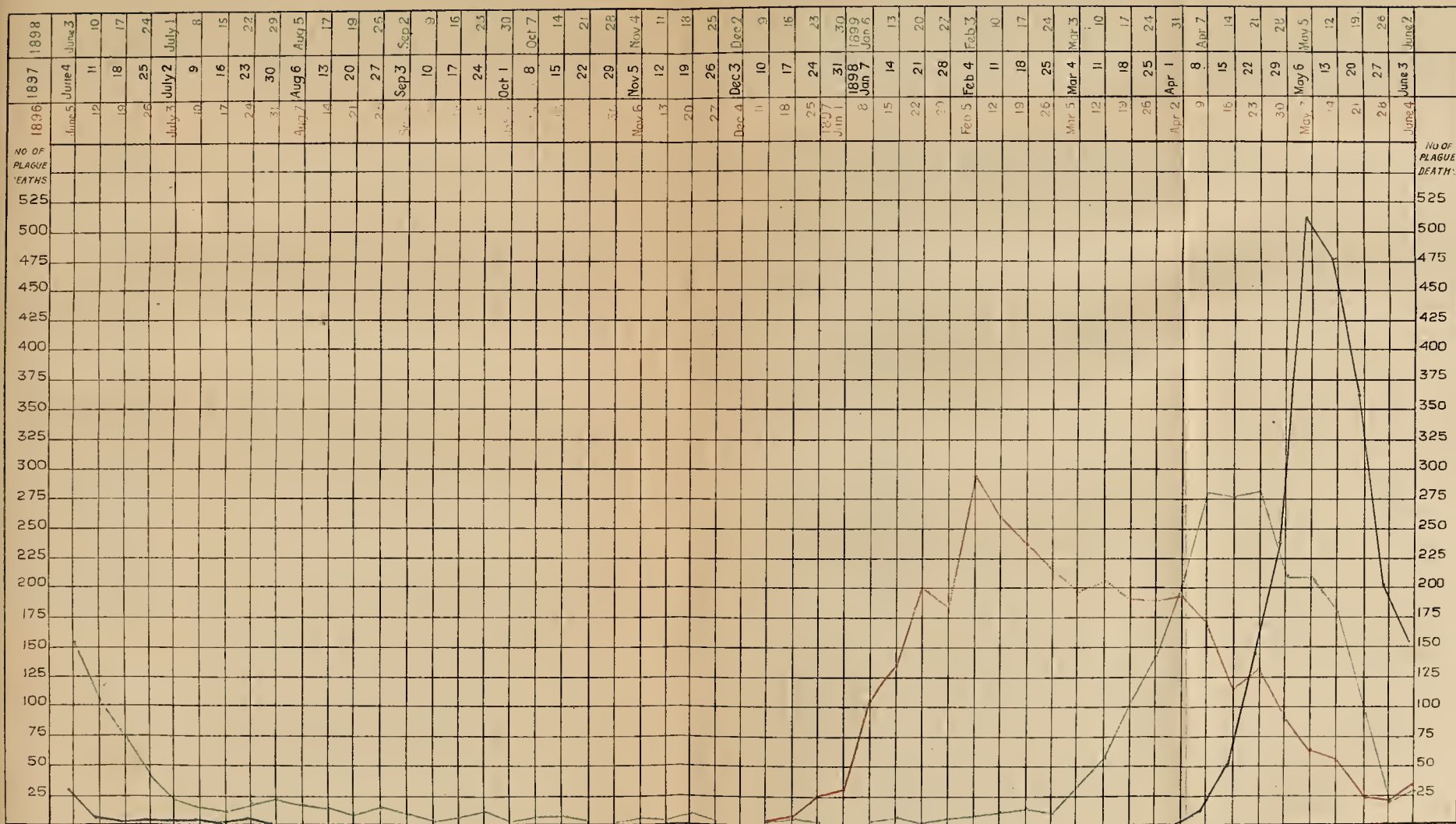
There was no indigenous plague during the third period at any other place in the Karachi District, although 14 cases—8 deaths were imported into various places outside the Karachi Taluka.

Charts shewing weekly plague mortality in Karachi City and District are given opposite.

KARACHI CITY

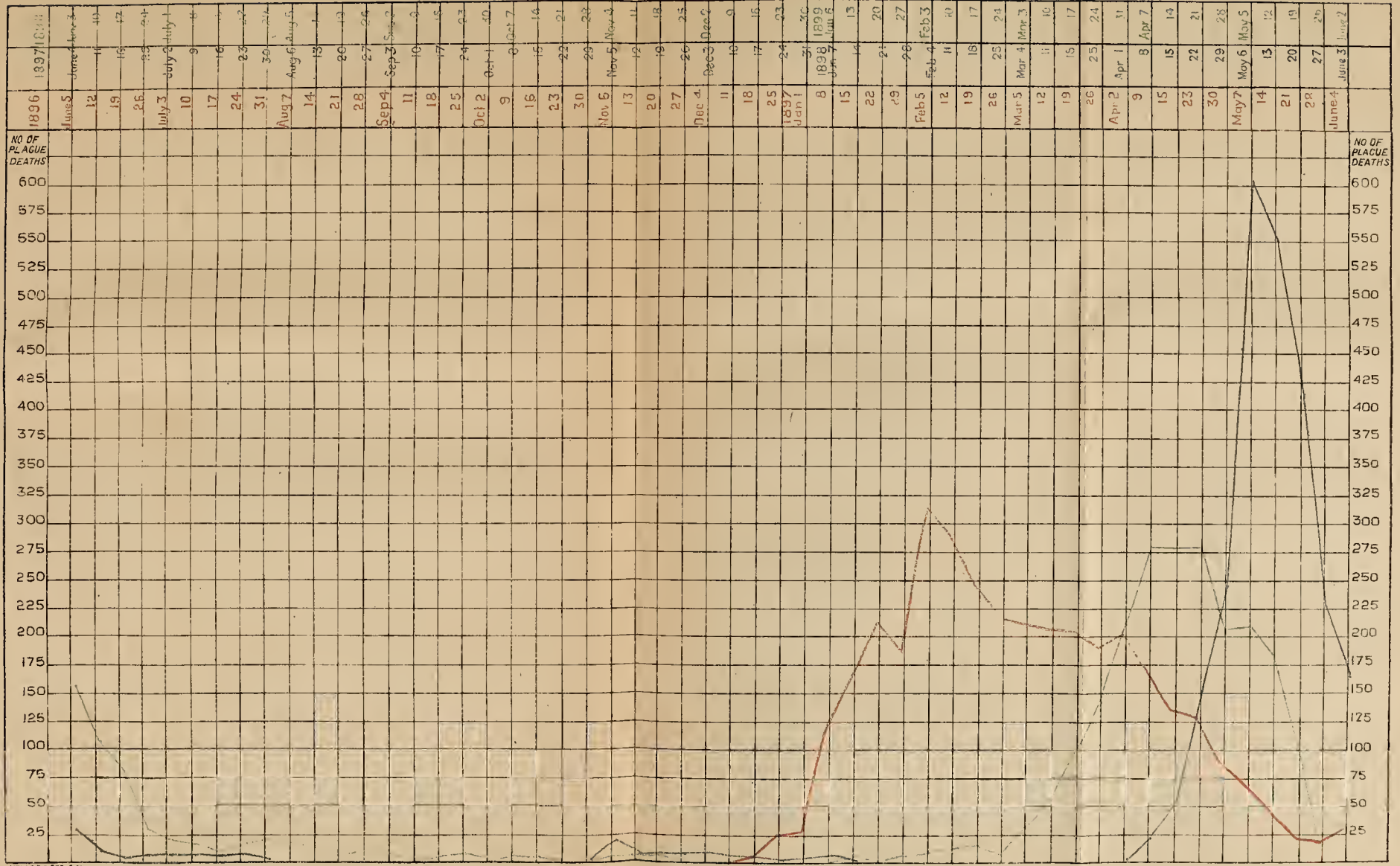
Population 98,195.

Chart showing Plague Mortality.



KARACHI DISTRICT.

Chart showing Plague Mortality.



SHIKARPUR DISTRICT.

Area	8,148 sq. miles.
Population in 1891	915,497.
Density of population	112·36 per sq. mile.
Rainfall	About 5 inches.

The Shikárpur District, lying in the extreme north of Sind, is bounded on the north and west by Baluchistán ; on the east by the Rájputána Agency ; and on the south by Karáchi and Hyderabad.

Boundaries.

The climate of Shikárpur District is hot and dry, with a remarkable absence of air-currents during the inundation season ; and it is, in consequence, very trying to a European constitution. The hot weather commences in April, and ends in October ; it is generally ushered in by violent dust-storms ; the cold season begins in November, and lasts till March. The general aspect of Shikárpur District is that of a vast alluvial plain, broken only by low limestone hills, which tend to preserve a permanent bank for the Indus. Towards the west rises the Khirthar range, with an extreme elevation of upwards of 7, 000 feet, forming a natural boundary between Shikárpur and Baluchistán. Large patches of salt land, known as *Kalar*, occur frequently, especially in the upper part of the District ; and towards the Jacobabad frontier, barren tracts of clay, and ridges of sand hills covered with caper and thorn jungle, constitute a distinctive feature in the landscape.

Previous epidemics.

There is no previous authentic record of plague in Shikárpur, the principal disease being malarial fever.*

The first case of plague in Sukkur was reported by Major W. A. Corkery as having occurred on the 12th February ; and on the 25th and 26th four more cases were reported. Lieut.-Colonel A. H. Mayhew, the Collector of Shikárpur, went to Sukkur to inaugurate measures, and remained there during the outbreak. Sukkur, like Karáchi, shows no imported cases. The same orders which had been issued to the Collector of Hyderabad were issued to the Collector of Sukkur, and the same steps taken, and the progress of the disease is remarkably similar in both these districts:—

Week ending	HYDERABAD.		SUKKUR.	
	Local.		Local.	
	Cases.	Deaths.	Cases.	Deaths.
26th February 1897	...	...	4	1
5th March	3	2	6	8
12th "	5	4	14	9
19th "	42	29	28	19
26th "	40	27	97	76
2nd April	33	25	105	56
9th "	117	58	111	75
16th "	119	104	87	59
23rd "	75	68	42	50
30th "	49	40	17	16
7th May	37	32	13	8
14th "	13	12	6	5
21st "	8	8	4	5
28th "	1	2	1	1
4th June	2	2	1	1
	...	...	Add 12th Feb. 1	Add 7th July 1
Total	544	413	537	391

* Imperial Gazetteer of India, Vol. XII.

Major R. J. Baker, I. M. S., was sent to Sukkur, and in company with Major Corkery made a thorough house-to-house inspection of the infected locality, reporting 2 cases in the Isolation Camp and 1 in the Health Camp. The stringent removal of the sick led to the flight of about 10,000 people, and three-fourths of the inhabitants of New Sukkur fled to the neighbouring villages.

Messrs. P. R. Cadell and W. H. Lucas and Major Baker (who had been placed on special inspection duty) all arrived in Sukkur about the end of March; and shortly after, Lieutenant A. E. Beadon, with 30 men of the Wiltshire Regiment, appeared on the scene.

The Acting Commissioner paid two visits to Shikárpur and three to Sukkur during the outbreak. Gharibabad was the worst infected corner of New Sukkur, but Mr. Lucas removed the whole population of the quarter (about 600) to the Health Camp on the 17th April, and not another case occurred.

The disease gradually died down during April, and the last case occurred on the 2nd June 1897.

Shikárpur escaped lightly, owing to the able defence of Captains C. J. Milne and E. S. Clark, I. M. S., warmly supported by the people, who equipped two large Plague Hospitals. The Government Plague Hospital received the imported cases. Large Camps were standing to receive the population of any area that might be attacked. The railway and road approaches were carefully guarded, and every new-comer found himself in the Observation Camp. Rigid corpse-inspection also obtained, and deterred sick arrivals. The comparative immunity of Shikárpur is undoubtedly due to the attitude of the people themselves, led by the Judges, Messrs. Dayaram and Tyabji, and the City Magistrate, Ráo Bahádur Choithram.

Rohri was also badly infected. Mr. Mountford, I. C. S., was in charge, and fought the disease with energy. He was assisted by Lieutenants Leith, Hislop, and Bailey, who were indefatigable. A small steam disinfecter, with a bathing shed attached, was used, and larger ones at Shikárpur and Sukkur.

Plague also appeared in the following places, but did not develop into a serious epidemic in any of them :—Abad, Táluka Sukkur ; Thati, Táluka Rohri ; Other places. Miani Baghat, Táluka Rohri ; Tando Mir Muhammad Hasan, Táluka Rohri ; Larkhána (imported cases only) ; Khairpur Dahirki, Táluka Ubauro ; and a few others. The Thar and Párkar Districts, and the Upper Sind Frontier, escaped practically scot-free with 3 cases—2 deaths, and 4 cases—3 deaths, respectively : all, except one, imported.

CHAPTER XI.

AGENCIES AND STATES.

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CUTCH STATE.

Area	6,500 sq. miles.
Population in 1891	558,415.
Density of population	About 85 per sq. mile.
Rainfall	...	...	...	...	...	About 14·3 inches.

Cutch State is bounded on the north and north-west by the Province of Sind; on the east by Pálanpur State; on the south by Káthiáwár State and the Gulf of Cutch; and on the west and south-west by the Indian Ocean.

Boundaries.

The climate is mild and agreeable, except during May and June, when a burning wind and dust-storms prevail.

There is no permanent river, but in the rains streams of considerable size flow from the central hill ranges northwards to the Rann and southwards to the Gulf of Cutch. At other times a succession of pools marks the courses of these streams. The subsoil is rocky; the upper soil porous, which makes the storage of water in ponds and reservoirs difficult; but at no great depth from the surface, water abounds; and excellent wells are consequently numerous. There is no railway communication; there is a sea route to and from Bombay, and land routes to and from Sind and Káthiáwár.

[Climate and natural features.

Epidemics of plague occurred formerly in Cutch in 1812 and in 1815. In 1812 Cutch was visited by a pestilence of such severity that half the population is said to have perished.

Previous epidemics.

In 1815, the year of the heaviest known rainfall, it was again visited; East Cutch (Wágad) being attacked and suffering severely.

In 1878, the year of the heaviest rainfall since 1815, a virulent type of fever appeared in every part of the province. About 100,000 were attacked, of whom 12,500 died. *

First Epidemic.—The date of the first case of plague in Cutch was the 3rd October 1896. It was imported from Bombay. From this date to the 28th of February 1897, 47 imported cases (25 fatal) were reported. Indigenous plague appeared on the 4th January 1897; and from the beginning of February 1897 plague was epidemic. Mándvi Town (population, 38,155) suffered very severely, with 4,359 cases—3,853 deaths up to the end of August 1897, the rest of the Agency reporting 840 cases—641 deaths; but the figures are unreliable and can be taken as approximate only. Plague appeared at 24 places in all.

Cutch State.

Population—558,415.

Second Epidemic.—Plague did not cease during 1897 in the State, but only three places were infected at the beginning of July in that year, besides Mándvi, in which plague was rapidly dying out. The second epidemic may be said to have begun at the beginning of September 1897, when Mundra Town was attacked and the number of infected places in the State rose to 13.

Mundra Town remained practically free during the first epidemic, some 43 cases in all being reported between February and June 1897. Of these the large majority were imported. During the week ending 27th August 1897, 6 cases—4 deaths occurred, and a moderate

Mundra Town.
Population—10,433.

* *Bombay Gazetteer*, Vol. V.

epidemic now took place, reaching a climax of 53 cases—46 deaths during the week ending 29th October, and dying out towards the middle of December 1897, the totals being 487 cases and 362 deaths. With the exception of an imported case on the 28th March, Mundra remained free during the year 1898.

The preventive measures adopted in Cutch at this time may be mentioned here. They were chiefly the closing of all ports in Cutch, except Mándvi and Khari Rohar, the latter being also the point of entry by land route from Bombay, Gujarat, and Káthiáwár; and the placing under observation for 10 days of all arrivals at these ports, except those from Karáchi, who underwent observation before leaving that port, and were therefore admitted into the town after being medically examined and disinfected. Four camps were built for this purpose at Mándvi Bandar, and a fifth was added for the removal of those who might develop suspicious symptoms. An additional camp for Mahomedans was erected at a distance of a mile from the Bandar. The camps were opened on the 7th October 1897 and closed on 22nd July 1898, and during this period 15,958 people were detained, the number of plague cases found among them being 22—of which 19 proved fatal—all amongst the Hindus from Bombay. The system of observation and disinfection was thorough, and a roll was called daily and the inmates of the camps medically examined twice a day. The arrangements at Khari Rohar were similar though on a smaller scale. There was also an observation camp at Mundra.

As regards the spread of plague in Cutch generally, Major G. E. Hyde-Cates, the Political Agent, is of opinion that the infection was chiefly due to Mándvi, and to Mándvi also he attributes the infection of Mundra:—

“The spread of plague was undoubtedly in the first instance carried by persons leaving Mándvi. Maska and Gundiali were the first infected, the first village being only a mile from the city, and the second six miles, but the intercourse between this village and Mándvi is considerable. Godhra, 8 miles, and Bada, 14 miles, were also probably infected from Mándvi; while the disease is known to have been carried to Mahápur by personal infection from Mándvi.

“At the time the first villages were attacked, the plague in Mándvi was at its height, and sufficient attention could not be paid to them, so that they, in their turn, infected other villages. Fortunately, in the case of some, the disease stopped after a few cases.

“In the Mundra District there is no doubt that Mundra itself was infected from Mándvi, although Kapaya, a village 3 miles from Mundra, was infected a month earlier by persons from Mándvi. Owing to the severe epidemic in Mándvi, numbers of people were flying all over the place, and one could only trust to the Wahiwatdár of Mundra and the Dhúrís in charge of the villages to carry out the orders for placing persons from Mándvi or any infected place in ten days’ quarantine outside the villages. These orders were not stringently carried out in the case of Mundra, and any well-to-do person found no difficulty in getting into the town. The plague being an altogether new experience, the headmen of the towns and villages could not be brought to see the importance of forcibly keeping out infected people nor was their disobedience of orders properly dealt with by the Darbár at that time. It is quite possible and probable that Mundra had several indigenous cases before it was reported as an infected town.”

Room was found in some *pukka* buildings in an enclosure for five good caste hospitals, and another building was set apart as a segregation hospital. Dr. Damania superintended these and all other plague measures in Mundra, assisted by Captain W. S. P. Ricketts, I. M. S., 17th Bombay Infantry, who performed plague duties in addition to his own; Captain H. D. Mason, R. A. M. C., came to Mundra when the latter fell ill; and later, when Captain Mason left Mundra, Dr. Karanja was left in charge of the hospitals. In December 1897, Mándvi being practically free from plague, Dr. Mason again took up his quarters at Mundra.

Twenty-five places reported cases in this Táluka, but of these 9 had less than 5 cases each.

Mundra Táluka--other places.
Population—25,650.

The total number of cases in Mundra Táluka and in the towns of Mundra, Toda, Luni, &c., are given in the table of attacks below.

Mándvi Town and Salaya.
Population—38,155.

The rise and progress of the second epidemic in Mándvi are thus described by Major Hyde-Cates:—

“Towards the end of December 1897 and beginning of January 1898, 3 or 4 cases occurred amongst the Meghwals living outside the Sonáwálla Gate of the town. In each case the house or hut in which the case occurred was burnt down and the contacts segregated. Finally this colony of Meghwals, being a standing danger, was removed to a site about a mile from the town, where they were given assistance in building huts for themselves on a systematic plan.

“On the 23rd February a case occurred amongst the Mahomedans living in houses adjoining the old Meghwal quarters, and a block of houses containing some 80 people was evacuated and the persons segregated for 20 days. No further case occurred amongst them.

“It was not till the end of March that indigenous cases began to appear with any regularity, and then only 1 or 2 a day, but during the period January 16th to April 7th there had been 25 imported cases with 15 deaths. All these cases were from Bombay, and occurred in the observation camps. . . .

“During January, there had been only 3 or 4 indigenous cases amongst the Meghwals as reported above; during February, there was only 1 indigenous case; and during March 8 cases with 8 deaths. During April cases occurred in ones and twos till the 30th April brought 4 cases, the total for that month being 20 cases and 15 deaths. May saw the commencement of the recrudescence in earnest, and during the week April 30th to May 6th, cases went up with a bound from 6 cases and 2 deaths the preceding week to 44 cases and 32 deaths. The second week in May showed 42 cases and 29 deaths, the third 64 cases and 36 deaths, the fourth week 81—63 and 33 cases and 23 deaths for the remaining period of May 28th to 31st. Up to date of writing (20th August 1898), May has been the worst month, the total cases during this month going up to 260 cases—179 deaths, and the grand total from the start of the recrudescence, which may be put down as the 10th March last to 31st May, amounts to 288 cases and 202 deaths.”

Indigenous plague began with cases amongst the Saláts. This caste lives in the Návapura quarter of the town—a dirty, crowded and insanitary locality inside the fort. Throughout the previous epidemic this caste had enjoyed immunity from the disease while the Khattris had suffered. On this occasion the Khattris were comparatively free, while the Saláts suffered.

The disease in this epidemic was much less severe: and Major Hyde-Cates attributes this decrease in virulence to the check placed on it by the following measures:—

- (a) Evacuation.
- (b) Death registration and death certificates.
- (c) Segregation of whole blocks round the infected houses.
- (d) Removal of the tiles some time previous to recrudescence.

On the operation of these measures, Major Hyde-Cates makes the following remarks:—

“(a) First and foremost, evacuating the town. So far back as February 1898, the Darbár Chief Plague Officer called a meeting of the headmen of the castes, at which Dr. Mason and myself were present, and we pointed out to them the advantages of turning out and the serious consequent which would probably ensue if they neglected the advice and did not get their caste people to go out. Some went out soon after this, but we had to have one or two subsequent meetings, and it was not till the end of April, when cases had been occurring daily during the month, that any appreciable difference could be noticed in the numbers in the town. When the cases rose suddenly to 44 in the first week in May, the people began to turn out in

large numbers, and by the middle of May there could not have been more than 4,000 to 5,000 people left in the town out of a population of between 35,000 and 40,000. The majority remaining in were weavers who have their looms in their houses and the Mahomedans of all classes. A certain number of these latter were also got out ultimately, and the Darbár assisted them to the extent of distributing Rs. 1,200 amongst the poorest of them. No sooner, however, had we got some of the Mahomedans out than a heavy storm came on, and they at once bolted back to their houses, with the result that latterly the Mahomedan quarter was attacked and they kept the plague going.

“(b) In January, at my suggestion, a notice was issued that no dead body would be allowed to be disposed of until a certificate of death had been given, and Police and Karkuns were stationed at the gates of the town and the burial and burning grounds to see that no body was disposed of, except on production of the certificate. The people were at the same time informed that if any sickness was reported and the person seen by the doctor before death, an examination of the corpse would not be made and the necessary certificate given without further trouble. The work of examining sick persons and granting of certificates was placed in the hands of a well-qualified and trustworthy Hospital Assistant, and the scheme worked admirably, particularly in the beginning. By this means cases were at once detected after being only a short time sick and taken to hospital, and prompt measures were taken with the infected house and those adjoining it.

“(c) *Segregation of whole blocks.*—This could only be done as long as the plague was kept within reasonable limits, as otherwise a very large segregation camp would have been necessary. Later on, when the cases increased during the first week in May, only one or two houses on either side of the infected house were treated in the above manner when found occupied; but as the people turned out in earnest, the houses were frequently found unoccupied, the residents having gone to live in the Wadis. The segregation camp for the persons turned out of the houses surrounding an infected house was established on a *maidan* about $\frac{3}{4}$ mile from the town and across the river. The camp was in charge of a guard of the 1st Bombay Grenadiers. The people were allowed to go to their work during the day, except the actual contacts, who were kept separate from the rest. These latter were kept in strict segregation for ten days and then allowed to go to work for the remainder of the segregation period, which at first was fixed at twenty days, but latterly, owing to the numbers coming in, the period was reduced to ten days. The poorest classes and those whose work was in their houses were fed by the Darbár.

“(d) *Removal of tiles.*—As to how far the removal of tiles from a house before the period of recrudescence arrived really does good, I am not in a position to say with any reliability, but I give the facts gleaned for what they are worth. Of course, this measure can only be beneficial in the case of basement houses. It occurred to me last January that if a recrudescence was to be expected about March or April, the removal of a good portion of the tiles from houses in the City of Mándvi and suburb of Salaya, thereby letting in sun and air to the interior, might do good, and certainly could do no harm. This was done in Mándvi and Salaya about January last, but was not done in the case of the houses outside the city walls, where a population of some 6,000 persons reside for the most part in basement houses. Salaya contains a population of about 4,000 persons, chiefly fishermen and sailors, all living in basement houses. Last year this suburb of Mándvi was reeking with plague, and though the death-rate cannot be accurately stated owing to its having been incorporated with Mándvi, the number of deaths amounted to certainly 1,000. A population of about 5,000 persons also live in such houses within the city walls. Now, up to the 31st May there had only been one case of plague in such houses in Salaya, and only three in the city, and from two of these houses I found that the tiles had not been removed. On the other hand, amongst the same kind of houses outside the city walls, from which the tiles had not been removed, there were up to the 31st May 31 cases. I did not pay any attention to the matter at first until I found in my daily rounds that no cases seemed to be occurring in these basement houses which, belonging to the poorest classes, are naturally situated in the worst part of the town, and where (especially in the Khatri quarter) the plague was very bad last year. Since the rains commenced and the tiles were put on again, there have been several cases in Salaya, but only six or seven in such houses in the town. I cannot then say for certain whether this measure assists in killing the recuperating germ and checking the disease.”

By the middle of May, therefore, the town was nearly empty, and the following statement shows the number of cases occurring *outside* and *inside* the town respectively :—

On the 1st of May 1898 there were	{	in camp	...	35,000
	{	in the town	...	5,000

Week ending		NUMBER OF INDIGENOUS CASES IN		REMARKS.
		Camp (35,000).	Town (5,000).	
6th May	1898 ...	14	30	
13th	" ...	20	22	
20th	" ...	14	50	
27th	" ...	30	51	
3rd June	" ...	19	36	
10th	" ...	16	30	
17th	" ...	15	43	9 in Salaya.
24th	" ...	8	20	1 do.
1st July	" ...	6	12	
8th	" ...	13	20	3 do.
15th	" ...	9	29	6 do.
22nd	" ...	10	26	9 do.
29th	" ...	10	23	8 do.
5th August	" ...	9	28	9 do.
12th	" ...	3	19	9 do.
19th	" ...	3	35	24 do.
26th	" ...	7	29	17 do.
2nd September	" ...	...	22	9 do. and 7 cases in Post Offices, hitherto immune.
Total for 4 months ...		206	525	104 cases in Salaya.

These results may be compared thus :—

Locality.	Population.	Period.	Number of Cases.	REMARKS.
Outside the town ..	35,000	4 months ...	206	Includes houses out- side the town. Excluding Salaya.
Inside the town ...	5,000	4 ,, ..	421	
Salaya	4,000	2½ ,, ...	104	

Captain Mason inoculated 1,044 persons of all ages with preventive serum obtained from the Pasteur Institute. The results were very satisfactory, for only 5 of these were attacked with plague and 3 of them recovered. The two fatal attacks occurred in a brother and sister 12 days after inoculation.

A noteworthy feature of the epidemic was the immunity enjoyed by certain classes of people. The Political Agent observes—

“The immunity among the sweepers and whitewashing parties which made up a large number of persons is noticeable. Up to the date of this report, 31st May, there has not been one case amongst this class, who were all accommodated outside the town in chappar huts.

“Another class which always seems to enjoy immunity from plague are the Wághris living in mud huts with thatch-roofs out in the open. The wealthy well-to-do have classes also been more or less free.”

The period required to lapse before re-occupation of infected houses was originally a month, but was subsequently reduced to 20 days, and later to 10 days. No evil can be said to have resulted from this measure, for only in three instances did cases occur after re-occupation. As regards the attitude of the people, Major Hyde-Cates remarks :—

"The people are certainly beginning to see the good of some of the measures. There has been more than one instance where villagers have prevented any one from an infected village coming to live in theirs, and they also begin to see the good results of turning out, as many have turned out, at once on the first cases occurring, without waiting for any persuasion."

The following table shows the villages attacked, Táluka by Táluka :—

Village.	Population.	Date of First Case.	TOTAL.		REMARKS.
			Cases.	Deaths.	
<i>Mándvi Táluka.</i>					
Maska	1,642	9th March 1897..	163	139	
Gundiali	4,280	10th " " ...	240	214	
Kodae	3,011	8th April " ...	331	22	
Bada	1,400	11th May " ..	75	66	
Merán	1,318	24th " " ...	99	85	
Náná Bhadia	1,077	26th June " ...	61	45	
Godhra... ..	1,992	4th July " ...	108	98	
Nagalpur	1,058	28th Aug. " ...	30	30	
Mahápur	242	4th Sept. " ...	36	36	
Baet	1,197	17th " " ...	68	66	
Rán	1,069	11th Oct. " ...	30	29	
Mándvi... ..	38,155	14th Jan. 1898 ...	292	205	
13 other villages	12,318	.....	51	43	
Total ...	68,759	...	1,286	1,078	
<i>Mundra Táluka.</i>					
Mundra	10,000	17th April 1897...	505	367	
Toda	350	17th Sept. " ...	61	55	
Barai	1,159	27th " " ...	46	38	
Sadan	753	5th Oct. " ...	77	73	
Kapaya	1,260	29th " " ...	75	59	
Beraja	1,752	4th Dec. " ...	125	87	
Gundula... ..	1,498	" " " ...	67	52	
Luni	1,068	6th " " ...	61	46	
Patri	1,535	11th " " ...	40	33	
Moti Khákher	872	26th Jan. 1898 ...	34	30	
15 other villages	15,403	.....	123	96	
Total ...	35,650	.....	1,214	936	
<i>Bhuj Táluka.</i>					
Kera	2,009	1st April 1897...	139	99	
Daisra... ..	435	15th Sept. " ...	75	52	
Total ...	2,435	.....	214	150	

From September 1898 plague gradually decreased in Mándvi Town, and the returns for the weeks ending 2nd and 16th December 1898 were blank; but on the 30th of that month 6 cases and 4 deaths were reported.

Third Epidemic.—For three months after Mándvi ceased to return plague, the Cutch Agency was practically free, save for a few sporadic cases in the last week of December 1898

and it was not till the second week of February in the new year that signs of a recrudescence became manifest. This epidemic confined itself more particularly to Mándvi Town.

The returns, for the last week in February 1899, indicated that Mándvi was doomed to suffer a third epidemic, which, though not so severe as the first, returned at its worst point so many as 279 cases and 191 deaths for one week ending 14th April 1899. The steady way in which this epidemic grew portended long duration ; but on the 31st March the figures had doubled those for the previous week, and from that date the disease continued with unabated severity up to the 12th May 1899; the mortality having never gone below 110 between those dates. From the 13th May there was a marked decrease, the disease eventually dying out by the 16th June. The following are the figures :—

Month.				Number of		REMARKS
				Cases.	Deaths.	
1899.						
February	...	...	...	14	7	(For one week.)
March	...	...	...	388	266	
April...	...	...	...	898	656	
May ...	...	...	..	368	309	
June ...	...	...	..	24	23	(For two weeks)
Totals ...				1,692	1,261	

Excluding Mándvi which is now entirely free, the rest of the Agency still continues to return plague, the figures for the time between June 1899 and the present (September 1899) being :—

Cutch State.

Cases.	Deaths.
396	342

KATHIAWAR AGENCY.

Area	20,880 sq. miles.
Population in 1891 .. .	2,752,404.
Density of population .. .	131.82 per sq. mile.
Rainfall .. .	Average 23 inches.

Káthiáwár is a square peninsula, standing boldly out into the Arabian Sea, between the smaller projection of Cutch and the straight line of the Gujarát coast. Its physical features suggest that it may once have been an island or a group of islands of volcanic origin. It is bounded on the north-west by the Gulf of Cutch; on the east by the Gulf of Cambay; and on the south and south-west by the Arabian Sea.

Half-way along its northern border stretches a flat desert called the Rann, which in the rainy season becomes a shallow lake, and in the dry season is bare of vegetation and studded with deposits of salt. The climate of the Peninsula is, in general, pleasant and healthy. January, February, and March are marked by heavy dews and thick fogs. The hot weather months (April to June) are the healthiest in the year. In September and October the heat of the sun is acutely felt, though the weather is cloudy.

The west Gohilvád and Hálár is perhaps the pleasantest and healthiest part of the province. The neighbourhood of the Rann, though hot and dry, is not specially sickly, the people being healthy, stout, and good-looking. But the stagnant water and excessive vegetation of the Nál make it very unhealthy.

The soils of Káthiáwár may be classed under two main heads,—black and red, the red being considered slightly less valuable than the black. In this District streams abound, ponds and wells are fairly numerous, and there is much variety in the texture, quality and depth of the soil.

Káthiáwár suffered much from the plague, which attacked one or other part of Gujarát, Káthiáwár, and Cutch for a period of ten years between 1812 and 1821. This plague followed the famine of 1811 and 1812.*

In the beginning of the year 1897, Káthiáwár was again visited with this great scourge.

First Epidemic.—Plague began in Káthiáwár with two indigenous cases on 7th February 1897 at Wadhván Civil Station. During the following week cases occurred at Jodia on the 13th February and 18th February 1897. Quarantine camps were at once established and evacuation of infected and adjoining houses begun. The former were established at Bhávnagar, Verával, P. rbandar, and Jodia.

Colonel Kennedy, Administrator, Navánagar State, immediately visited Jodia, and Mr. O'Connor, Superintendent of Police, Navánagar State, watched events at Khambália.

Colonel J. M. Hunter, C.S.I., Political Agent, Káthiáwár, gives details of the first cases—

“On the 11th instant a man, his wife, and a female child of four years were found suffering from fever in a public lodging house in the Wadhván Civil Station. The man had bubonic

* *Bombay Gazetteer*, Vol. VIII.

swellings, but though these symptoms were absent from his wife and child, the Agency Surgeon, whom I deputed to the place, reported that they were plague cases. The child died soon after, but the man and his wife are still under treatment.

"From enquiries it transpired that another daughter of this man had died of fever shortly before these cases came to notice, and it is suspected her disease was also bubonic. The fourth case which was certified to be plague by the Medical Officer was that of an old woman who was living in the next room and who has since died. These persons were permanent residents of Wadhwan Civil Station, and are reported not to have gone to Bombay, though it appears that they had constant contact with people coming from Bombay. The sanitary condition of the house in which they lived is reported to have been unsatisfactory.

"The exact dates of attacks are reported as follows :—

(1)	7th February	—daughter aged eight years.	} In the same house.
(2)	8th	man.	
(3)	"	another daughter, four years.	
(4)	11th	wife.	} In a neighbouring house.
(5)	7th	old woman	

Cases Nos. 2 to 5 came to the notice of the Medical Officer of the Station, Assistant Surgeon Ráo Bahádur Thákordas Kikábhái, on the 11th, who at once took the necessary steps for segregation and disinfection."

Bhávsnagar and Kutiyána were the only two places where the disease established itself; no effort was spared to eradicate it from those two places and prevent its obtaining entry anywhere else. Strict medical inspection with observation camps was instituted for the latter purpose; and demolition, evacuation and disinfection for the former. The results were satisfactory, as the total figures from 7th February 1897 to 2nd July 1897 were 261 cases—167 deaths, of which over one-third were imported.

Second Epidemic.—For six months there was no more plague, either indigenous or imported. But in January 1898 imported cases again began to occur, and continued to occur up to the middle of May, 33 cases being thus detected and detained. But menaced by infection as it was, both by road and rail and sea, Káthiáwár would have been fortunate indeed to have escaped scot-free. On the 19th February four cases occurred at Kutiyána, of which three were reported as indigenous. Was this recrudescence or re-infection?

Colonel Hunter makes the following remarks about it :—

"Telegraphic information reached me on the 19th instant that 1 imported and 3 indigenous cases of plague had been discovered in the town of Kutiyána on that day. These are the first indigenous cases that have occurred in this province since June last, and Kutiyána is one of the three places in Káthiáwár where indigenous cases occurred last year. The plague appeared there in January 1897 among arrivals from Bombay, but it was not reported until March, between which time and June, 94 indigenous cases occurred in a population of 9,300. The town remained apparently free from then till now."

Colonel Hunter apparently inclines to the belief that it was a recrudescence, but it seems more probable that it was re-infection. Kutiyána is on the line of communication, and it is more likely that as it was infected from Bombay *viá* Porbandar in January 1897, so it was re-infected in 1898, than that the germs should lie dormant for seven months and then suddenly spring to life again. The theory of re-infection is, moreover, strengthened by the fact that the same houses were not attacked in the two years, as Colonel Hunter states—

"The disease this year has *not* returned to the houses affected last year. The cases have occurred in another locality."

But, however this may be, the pestilence had arrived, and no time was lost in combating it. A cordon of 50 Imperial Service Lancers was drawn round the town

to prevent spread, and the usual measures of evacuation and disinfection, etc., were at once adopted. On the 24th February, Colonel J. M. Hunter, the Political Agent, and Major A. V. Anderson, I. M. S., arrived at Kutiyána to inspect the measures already in force and to institute such others as might be necessary. Their first care was to thoroughly investigate the circumstances under which the cases had occurred, but they could discover little, and the following meagre details were all that could be learned :—

“ Porbandar and Mángrol are the two nearest ports through which there had been numerous arrivals during the past two months from Bombay, but it was impossible to trace the importation of the disease to any particular individual. The imported case on the 19th was that of a man who had arrived in the town about a month before and had undergone 10 days’ observation at Porbandar.

“ I am inclined to think the disease had existed for some little time without discovery owing to the neglect of the rules which I introduced last year for the registration of deaths and the examination of all bodies before disposal to ascertain the cause of death. This is much to be regretted, as earlier measures might have prevented the disease becoming indigenous and saved the Darbár the trouble and expense which will devolve upon it now, but which will be a salutary lesson in future.”

On inspecting the city they found the ward system with census parties in full swing; and medical portion of the operations under Dr. Vaishnav, who treated the victims in caste hospitals outside the town. Houses in which cases had occurred were completely evacuated and disinfected. They instituted the following additional measures :—

1. Observation Camps.
2. Segregation Camps.
3. Contact Camps.

These were erected on the spot and the whole of the population of the infected portions of the town sent out into one or other of them.

Lieutenant R. S. Pottinger, Assistant Political Agent, was appointed Special Plague Inspecting Officer. A few indigenous cases at Kutiyána and imported cases at Bhávnagar and Mángrol occurred during the next few weeks: but the measures in Kutiyána were not without effect, for on 15th March 1898 Colonel Hunter reports—

“ On the 1st March Mr. Pottinger, Assistant Political Agent in charge Sorath Pránt, who has been placed on special plague duty to inspect the several port observation camps, etc., accompanied Surgeon-Major Anderson during his second visit to Kutiyána and superintended the transfer of about 1,000 people from the infected quarter of the town to the health camp. Dr. Anderson’s report has not yet reached me. These measures have had a marked effect. For several days there were no cases in either camp or town, while the latter has been free for the last eight days.

“ On the 2nd instant I visited the observation camp at Bhávnagar in company with His Highness the Thákór Sáheb and Dsernderson, and found all the arrangements satisfactory.

r. A

“ I am glad to report that the measures to prevent the plague spreading from Kutiyána have so far been completely successful, as the disease has not appeared elsewhere in the Province.”

It will be noticed that the town had been free for eight days. The following week the town was free again. This leads Colonel Hunter to say—

“ The measure of clearing out the occupants of the houses in the infected quarter has effectually prevented the spread of the disease in the town.”

The following week, 25th March 1898, there was no case at all: and only 1 death in a previous pending case; and during the next month only 4 cases in all occurred. Indeed, from the beginning of April to the 20th May no indigenous plague was reported from the Agency, but imported cases continued to be detected at Porbandar, Wadhván and Bhávnagar.

Third Epidemic.—The next phase of plague in Káthiáwár was the sudden infection of Porbandar. Up to 17th May 1898 Porbandar had reported nothing but imported cases, although increased mortality among the Khárwas had been noticed from the beginning of the month.

Porbandar Town.
Population—18,805.

During the next two days it reported 4 cases, and in the succeeding week 37 cases—26 deaths.

The origin of the outbreak is unknown :—

“As it is impossible to say which was the first case of plague, the channel of its introduction cannot be confidently determined, but the Medical Officer here is of opinion that the disease has been communicated by direct contagion with some infected articles imported by the country boats into Porbandar, probably cotton-seeds, of which great quantities have lately come from Karáchi and other places.”

The first measure adopted was the prevention of the Khárwas mixing with the rest of the population. House-to-house inspection was carried out in the Khárvavad by a Committee composed of 1 State official, 1 medical man, and 4 headmen of the community. Plague cases were removed to a hospital, and contacts to an observation camp established on the other side of the creek, and orders were issued for a thorough whitewashing and disinfection of vacated houses.

It was, however, felt that nothing short of complete evacuation of the locality would be effectual. The Khárvavad is described to be a place consisting of about 900 houses “most of which are so crowded together, so inaccessible to light and air, and otherwise so insanitary as to be almost unfit for occupation by human beings.” After some persuasion the Khárwas agreed to remove to the observation camp beyond the creek and the evacuation of the quarter was carried out with commendable despatch. “Hutting materials were supplied to them, and by the evening of the 20th May and within 24 hours of their having consented to vacate their houses, the whole of the Khárwa community, numbering about 3,500 persons, was located in huts built by themselves in the observation camp. The Shiah Borahs, Kabavalias and others who lived either in the Khárvavad or in the immediate vicinity were also segregated.”

After the removal of the Khárwas to camp, their houses were disinfected and opened up to light and air. A permanent improvement was effected by opening up the congested part of their quarter and several houses were pulled down and substituted by others constructed on approved sanitary principles at the public expense.

These vigorous measures promptly checked the epidemic, and between the 25th of May and the 12th of June 1898 there were only 4 cases. But the monsoon burst on the 11th of June and re-occupation of vacated houses had perforce to be allowed. In spite of all precautions, plague again broke out on the 13th June in the Khárvavad, and as it showed no signs of abatement the authorities once more decided on evacuation and commenced building watertight sheds capable of accommodating 3,500 people on the other side of the creek. But they were determined to lose no time in turning the people out, and, until the camp was ready, accommodated 1,500 people in some 65 vessels which were lying moored in the creek, as the trading season had closed. Others were housed in some available buildings and in temporary huts. On the 8th July the camp was ready and the whole of the Khárwa community was transferred to it, and their neighbours to other camps.

Meantime, however, the disease spread to other quarters of the town, and complete evacuation was an impossibility. All that could be done was house-to-house inspection, removal of patients to hospital, and contacts to segregation camps, with disinfection of houses. The Mahomedans, who numbered 4,369, and next to the Khárwas returned the largest proportion of victims, were also removed to camps. The progress of the epidemic is thus described by Lieutenant-Colonel F. W. Snell, the Administrator of the State :—

"The temporary camps in which the Khárwas were accommodated in the month of June had necessarily scanty accommodation. In that month I find that 33 cases of plague occurred in the camps. In July these people were removed to the spacious camp on the other side of the creek, when there were 13 seizures only. The inhabitants of the Rathod Falia, the Darbár Delo and the Panch Hatdi had 113 attacks in August. After the segregation of the Mahomedans living in these localities, the attacks fell to 13, including those in the camps. The spread of plague in the town was gradual from the time it first appeared in the Khárvavad. The new town which is furthest from the Khárvavad was the least affected. This fact leads to an inference that plague germs do not contaminate the atmosphere where sanitary arrangements are fairly satisfactory."

Many circumstances, besides the fluctuations in the numbers of cases, rendered the Porbandar outbreak remarkable. It began in the hot weather, and continued all through it; the first people attacked were mostly females of the Khárwa caste, while for many weeks the other communities, living beside them in the same crowded localities, remained unscathed. Rats again had no perceptible connection with it.

"No dead rats were discovered," writes Colonel Hunter, "either before or after the outbreak."

The epidemic ran a lengthy course in Porbandar, cases occurring up to the middle of November 1898.

The following statement shows the number of monthly attacks and deaths:—

Month.				Cases.	Deaths.
May	1898	—4 weeks	...	44	29
June	"	—4	" ...	61	38
July	"	—5	" ...	73	55
August	"	—4	" ...	137	119
September	"	—5	" ...	111	84
October	"	—4	" ...	34	27
November	"	—4	" ...	5	4
Total				465	356

The operations were carried out by the State officials under the direction of the Administrator and were very successful. The following remark by Lieutenant-Colonel Snell deserves mention:—

"Porbandar is one of the few places where plague has indirectly resulted in a benefit to the State, for, in addition to insanitary places having been cleaned and opened up, Rs. 47,544 have already been paid into the Treasury for land sold to people who wish to leave congested localities and to live either in the new town or beyond it. There is still a demand for land, and as it is unculturable waste, the State is recouping itself for all the expenditure it was compelled to incur during the past year."

Below are given the numbers for the whole of Káthiáwár, month by month, beginning with January 1898:—

Months.	Population.	Cases.	Deaths.	REMARKS.
* January 1898...	2,752,404	12	10	*All imported up to 25th February 1898.
† February " ...		24	13	
March " ...		28	16	† Only Kutiyána indigenous, all the rest imported.
April " ...		7	6	
‡ May " ...		45	30	‡ From 27th May, Porbandar only (all indigenous).
June " ...		61	38	
§ July " ...		114	77	§ Includes 19—8, Bantwa (indigenous).

Up to the 17th July 1898, then, Kutiyána and Porbandar were the only places in Káthiáwár where indigenous plague had appeared. But the spread was destined to become much wider. On the 17th July 1898 a new town appears, *viz.*, Sardárgadh with 2 cases—1 death; and the following week Bantwa, ultimately the worst infected of all, reports 19 cases—3 deaths, indigenous. Two weeks later (11th August 1898) Saláya is added to the list; and on 27th August 1898, Khambália. Thus the disease gradually spread, till, on 2nd November 1898, thirteen places suffered from indigenous plague. The following table shows the gradual spread:—

Town or Village.			Jurisdiction.	Date of first imported or indigenous case.			Source of infection.
Porbandar	...	...	Porbandar	...	17th February 1898	...	Bombay (probably).
Kutiyána	...	...	Junágadh	...	19th "	...	Do.
Sardárgadh	...	...	Sardárgadh	...	17th July	...	Kutiyána (probably).
Bantwa	...	...	Do.	...	24th "	...	Bombay. } (Uncertain Porbandar } which).
Saláya	...	...	Navánagar	...	11th August	...	Unknown.
Khambália	...	...	Do.	...	27th "	...	Do.
Nakra	...	...	Sardárgadh	...	10th September	...	Bantwa.
Sodhásli	...	...	Navánagar	...	11th "	...	Unknown.
Sodsála	...	...	Do.	...	12th "	...	Do.
Buri	...	...	Bantwa	...	24th "	...	Bantwa.
Khámbhla	...	...	Sardárgadh	...	6th October	...	Do.
Khákharda	...	...	Navánagar	...	31st "	...	Unknown.
Dánta	...	...	Do.	...	2nd November	...	Do.

From the 24th July 1893, the town of Bantwa, some 14 miles from Kutiyána, figured amongst the infected towns. As the scourge struck it with peculiar severity, practically decimating the population in a little over two months, it perhaps deserves more than a passing notice.

Bantwa is a town with a population of some 8,500, lying about 20 miles to the west of Junágádh. Plague was first reported there on the 24th July 1898, although there is little doubt that cases had been occurring for a month or two previous to this date, and that concealment was largely practised. If this was the case, the large numbers attacked are easily understood.

Bantwa Town.
Population—8,641.

Its origin is very uncertain. It may have been imported from Bombay, or it may have been imported from Porbandar, or, again, from Kutiyána. But the latter is most improbable. Colonel Hunter inclines to the former theory:—

“There is a difficulty in accepting Mr. Antia’s conclusions that the plague was introduced from Porbandar, inasmuch as that there have been no cases either among Memons or Sonis at Porbandar. It is more likely, therefore, that the disease was imported from Bombay in spite of the observation camps at Porbandar and Verával. The information on this subject where there are no registers of death is never reliable.”

Captain H. G. Carnegie, Assistant Political Agent, and Khán Bahádur H. J. Antia, Deputy Assistant Political Agent, were sent at once to the spot and set to work without delay. Two hospitals and two camps were erected some 300 yards on each side of the town by the 1st August, Hospital Assistants being placed in charge. Segregation and disinfection were also started. About the middle of August, Lieutenant R. S. Pottinger relieved Captain Carnegie who returned to Rájkot. Dr. Vaishnav (the Junágadh State Doctor) and Dr. Chubb (sent from Bombay at the request of the Shethias) arrived shortly after and extended the operations inaugurated by Captain Carnegie. Colonel Hunter and Major W. H. Burke,

Agency Surgeon, visited Bantwa about the middle of August and inspected all the arrangements. The weather at this time was most unfavourable. Heavy rains, storms, etc., made the camps almost uninhabitable, and rendered the drying of clothes impossible.

The cases leapt up from 19—8 (week ending 29th July 1898) to 153—103 (week ending 2nd September 1898). The following week, 9th September, the figures were 247 cases—134 deaths. Colonel Hunter applied for help, and Lieutenant J. K. Condon, 18th B. I., arrived on the 12th September at Manawadar with Lieutenant R. S. Pottinger, the Pránt Officer, who had been away on tour for a couple of days.

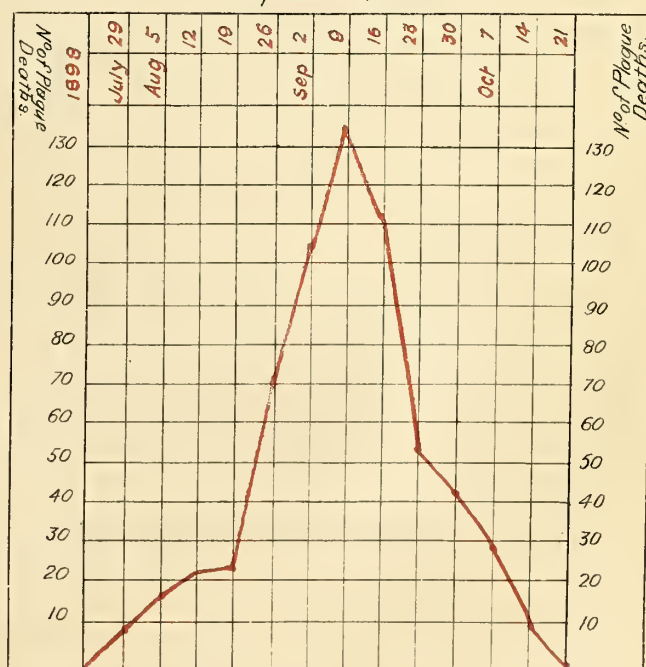
On the afternoon of that day (12th September 1898) a violent storm passed over the town and camps, leaving the whole place more or less under water. The condition of the camp produced a general stampede, which, augmented by a misunderstanding between the Police and the fugitives, and taken advantage of by a few *badmáshes*, resulted in an affray, in which the Police Faujdar and one of the Hospital Assistants were hurt. Several of the townspeople were said to have been injured, but the truth of this was never discovered. News of this reached Lieutenants Pottinger and Condon on their arrival about 6 P.M., and they at once rode out to Bantwa to see what could be done. A heavy storm was raging at the time, and the rain was falling in torrents. When they arrived, the town was apparently quite quiet. They then rode out to the camps. These were indeed a desolate sight. Empty, dilapidated and bedraggled tents were dotted about two large shallow lakes of water: and huts, blown down by the wind, lay, masses of sodden *débris*. Thence they went to the dispensary, where they found the two injured men and the Nyáyádhish, who gave an unintelligible account of the affair. The next morning broke clear and bright and saw them early at work. From this date the ward system, with evacuation and prompt disinfection, were all energetically recommenced and pushed forward; the fine weather which now set in making the task of getting the people out of the town gradually easier and easier, and at the end of 10 days (about 23rd September 1898) some 2,000 were once more out in camp, and more and more people segregated themselves daily.

On the 23rd September 1898, Khán Sáheb Fazl Ahmed, who had done very good work in Karáehi, arrived, and the results of his work soon testified to its excellence. The disease steadily subsided, and by the end of October had practically ceased. The last case occurred on the 4th November 1898, since which date the town has been free. The figures for this short but virulent epidemic are as follows:—

Week ending	Cases.	Deaths.
29th July 1898	19	8
5th August "	34	14
12th " "	42	20
19th " "	38	22
26th " "	119	60
2nd Sep t "	153	103
9th " "	247	134
16th " "	120	111
23rd " "	75	52
30th " "	57	40
7th Oct. "	25	26
14th " "	3	8
21st " "	...	...
28th " "	...	...
4th Nov. "	1	1
Total ...	932	599

BANTWA TOWN

Population 8,321



Unfortunately, the disease spread from Bantwa to three neighbouring villages, Buri, Nákra and Kambhála; but they were completely evacuated, and the disease consequently never got a firm hold on any of them, and died out in a brief space of time.

To return to the Agency generally—

Sardáragadh, a large town, was reported as infected on 17th July 1898, and Saláya on the 11th August. Dead rats were found previous to the outbreak in the latter place, and the occurrence of the first cases produced a panic. Lieutenant-Colonel W. P. Kennedy, Administrator, Navánagar State, writes—

“On arrival here with Mr. O'Connor on Saturday last, 13th August, I found the town almost absolutely deserted, the inhabitants having stealthily at night left the place through fear during the last few days. Approximately about two-thirds of the population have distributed themselves in 31 villages of this State, the rest, with the exception of those remaining in the place, embarked on 20 vessels, and were prepared to go, but were stopped by the Chief Customs Officer pending my arrival. Out of a population of 3,273, only some 100 townspeople remain; in addition to these, there are the State and Government officials and their families. Many of the townspeople have left, taking nothing with them and leaving their household property and ornaments and stores of merchandise behind.”

As regards its origin, he says—

“In my opinion the plague was not imported by human beings coming into the place from infected areas, and that everything points to its inception through rats which must have come from some infected port, Bombay, Karáchi, Mándvi (Cutch), Porbandar or Beyt, as there is frequent communication by sea between Saláya and these ports. But so far it is impossible to say to which of these places, one or more, the mischief is traceable.

“At any rate the plague in Saláya must be classed as indigenous.”

But it soon declined, and by the end of October there was very little plague in the Agency: Khambália alone showing 18—16 out of 39—35. The following table gives the monthly plague cases and deaths in the State (excluding Bantwa and Porbandar) from 1st August 1898 to 30th November 1898 :—

Month.						Cases.	Deaths.
August	1898	...	...	...	...	71	49
September	„	...	...	...	...	230	177
October	„	...	...	...	...	254	209
November	„	...	...	...	...	51	33
Total						606	468

Thereafter plague continued in a slight degree, but no indigenous case has occurred since the 17th March 1899. The figures, both imported and indigenous, reported from the beginning of November 1898 to 31st May 1899 are :—

Months.						Cases.	Deaths.
Goinj	...	...	...	...	..	21	15
Khakarda	...	...	...	...	..	17	17
Khambalia	...	...	...	...	..	12	12
Kambhla	...	...	...	...	..	14	9
Porbandar	...	...	...	...	..	11	6
Vadatra	...	...	...	...	..	10	8
Wadhwan	...	...	..	...	..	9	7
Other places	...	...	...	...	..	41	26
Total						135 *	100 *

* 30—17 imported.

KOLHAPUR AND SOUTHERN MARATHA COUNTRY.

Area	...	...	...	...	5,895 sq. miles.
Population in 1891...	...	...	...	...	1,552,401.
Density of population	...	...	...	...	263·34 per sq. mile.
Rainfall...	...	...	...	...	Average, 40 inches.

Kolhápur is bounded on the north by the Várna river, which, for about sixty-six miles from Prachitgad to its meeting with the Krishna two miles south of Súngle, separates Kolhápur from Sátára; on the east by the rivers Krishna and Dudhganga, Miraj and Súngli; on the south by Belgaum; and on the west by the Sahyádris. Súngli, the chief State of the Southern Marátha Country, consists of detached tracts extending from the British Districts of Sátára and Sholápur in the north to the river Tungbhadra in the south of the Bombay Presidency. The other States comprising the Southern Marátha Country are Miráj Senior and Junior, Kurundvád Senior and Junior, Jámkhandi, Mudhol, and Rámdurg.

The seasons may be broadly divided into wet, cold, and hot. The rainy months are the healthiest time in the year. The cold season, which lasts from November to the end of February, is the most dry and unhealthy part of the year. The climate of the Southern Marátha Country, though hot, is not unhealthy. In the rainy season the climate is everywhere pleasant, except perhaps in Sháhápur, where the rainfall is heavy and constant. In the cold season the air is dry and the nights cool. The soil may be classed into black, red and white; or again as good, middling, and poor.

There is no authentic record of plague either in Kolhápur or the Southern Marátha Country, cholera being the only great source of epidemic disease there.*

As this Agency consists of a number of States of varying size, which have suffered from plague epidemics at different times, and as, since November 1897, no single week has passed without plague being reported from the Agency, it will be convenient in this review to deal with each such State or portion of the Agency separately.

The measures taken to combat and control the disease were very similar throughout the Agency, the difference being mainly in the vigour and promptitude with which they were enforced at various places. They are therefore enumerated here, and may be understood as applying throughout the Agency at such places as were attacked. Concerning the protection of villages from infection up to June 1898, Colonel J. W. Wray, the Political Agent, reports as follows:—

“The inhabitants of every village have been urged to adopt a system of observation by which no strangers can enter their precincts without detention outside for 10 days, and the system has worked well and inexpensively, the Patels being held answerable for any carelessness that may cause the village to become infected.

“All approaches to the village are guarded by local arrangement, and even the postal runner who has been accustomed to pass through with the mail-bag has, by the courtesy of the Post-Master-General, been instructed to put down his bag on the border, and the bag is disinfected and taken in charge by a State servant who is held responsible for the safe delivery of the mail-bag.

* *Bombay Gazetteer*, Vol. XXIV.

“By these means regular communication between villages can be almost entirely suspended, but in the agricultural districts, where the lands of an infected village adjoin those of a non-infected one, as has been frequently the case in the Krishna valley and the Belgaum circle, it is quite impossible to prevent occasional contact between people working in the fields, and it is principally in this way that the Native State villages in my jurisdiction have become infected from adjoining British villages and from each other.”

During the following year these measures do not seem to have been much relaxed. As regards the measures taken to combat an incipient outbreak, Colonel Wray reports :—

“The most important consideration is the *prevention of concealment of cases*. For on this, more than anything else, in my opinion, depends the success or failure of the subsequent measures.

“There are two evils inseparable from a plague epidemic which in their turn prejudice all suppressive measures to a serious extent—namely, panic and apathy.

“The only way to deal with these is to anticipate them by giving the people themselves as much occupation and responsibility as possible in plague matters.”

Accordingly authorities were nominated by the representative inhabitants, who were responsible for—

- (i.) reporting all cases of sickness ;
- (ii.) encouraging evacuation on the occurrence of the first case of plague ;
- (iii.) enforcing the untiling and disinfection of houses ;
- (iv.) reporting all deaths.

This voluntary organization appears to have been both satisfactory and successful, for it was continued throughout the subsequent years (1898-99) also.

Plague first broke out in this Agency on the 23rd October 1896, when one case, imported from Bombay, occurred in Kolhápúr Town. After this there were 3 more cases imported into Kolhápúr Town, one from Bombay on 17th November 1896, the second from Poona on 30th January 1897, and the third from Bombay on 9th February 1897 : but the infection did not establish itself ; and, with the exception of the above cases, Kolhápúr Town remained free from plague throughout the period covered by this review. It has since been attacked.

Kolhápúr State.
Population—913,131.

Between the date of the first case and November 1897 there were only 129 cases—100 deaths throughout the whole Agency, Kolhápúr State alone returning 121—94, respectively.

The following measures were instituted to check the progress of the disease :—

- (i.) The inmates of the houses where plague cases occurred were removed instantly, and the houses burnt or dismantled ; and
- (ii.) Observation and segregation camps, the former for arrivals, and the latter for contacts, were established.

Kolhápúr remained practically free from plague from November 1897 to May 1898, when, however, the figures rose steadily ; the highest number of cases and deaths registered during any one week being 47—31, respectively, on the 25th November 1898, and the totals, from October 1896 to 2nd June 1899, 970 cases—764 deaths.

Sángli State became infected in November 1897, and up to 2nd June 1899 has never since been free for a single week. The average weekly numbers of cases and deaths for the whole period were 79—59, respectively. SÁNGli passed through a moderate epidemic, lasting from August 1898 to April 1899.

Sángli State.
Population—238,945.

The following statement compares the number of monthly cases and deaths in SÁNGli with the totals for the whole Agency :—

Period.								KOLHAPUR AND S. M. COUNTRY STATES.		SANGLI STATE.		
								Cases.	Deaths.	Cases.	Deaths.	
August	1898	—4	weeks	...	...	...	..	568	381	329	217
September	"	—5	"	...	...	...	...	2,341	1,551	1,009	642
October	"	—4	"	...	...	...	...	2,879	2,214	1,036	803
November	"	—4	"	...	...	...	...	2,691	2,033	748	593
December	"	—5	"	...	...	...	...	2,071	1,590	647	466
January	1899	—4	"	...	...	...	...	1,013	772	386	286
February	"	—4	"	...	...	...	...	1,014	744	341	239
March	"	—5	"	...	...	...	...	580	460	142	108
Total								...	13,157	9,745	4,638	3,354

Considering that there were 8 infected States in Kolhápur, it is worthy of notice that over one-third of the total plague mortality occurred in Súngli, leaving nearly two-thirds to be accounted for by the remaining seven States.

With regard to the infection of Súngli, Lieutenant-Colonel J. W. Wray reports :—

“A railway servant from the Hubli Workshops, where plague was prevalent, came by train as far as Shedbal, 18 miles from Súngli, walked into a Súngli field, remained there for the day and went stealthily to the priest's house at night, stayed there a couple of days and returned to Shedbal. Immediately after his departure his host's wife and son were attacked with plague and both died. Three other members of the family died also. As for the man himself, I believe he never had plague at all; so he must have brought it in his clothes.”

Infection may, however, not have been due to this man at all, but to some undetected cause.

Miraj (Senior) was first attacked on 24th January 1897. Infection was due to importation from Bombay. A few sporadic cases occurred till September 1898, when the mortality began to rise.

Miraj (Senior) State.
Population—88,343.

The following are the figures for the epidemic :—

Period.						Cases.	Deaths.	
September	1898—5	weeks	...	...	...	68	58
October	" —4	"	...	...	...	269	235
November	" —4	"	...	...	...	599	458
December	;; —5	"	...	...	...	360	276
January	1899—4	"	...	...	...	192	133
February	" —4	"	...	...	...	96	67
March	" —5	"	...	...	...	35	29
Total						...	1,619	1,256

179 cases—127 deaths on 11th November 1898 were the highest recorded during any week of the epidemic.

Miraj (Junior) was slightly infected, reporting only 576 cases—452 deaths for the three years during plague. It had a slight epidemic from August to December 1898, as the following figures show:—

Miraj (Junior) State.	three years during plague.
Population—35,487.	It had a slight epidemic from
	August to December 1898, as the following figures show:—

Months.						Cases.	Deaths.
August	1898	...	...	...	...	24	19
September	"	...	...	...	...	271	192
October	"	...	...	...	...	123	116
November	"	...	...	...	...	16	13
Total						...	434
						340	

Kurundvád (Senior) State was free from plague till the 20th December 1897, on which date one case was imported into Angol from Belgaum. Strict measures were adopted and the disease did not become epidemic; only 263 cases—138 deaths being reported during the 8 months from December 1897 to August 1898, giving a monthly average of 33 cases—17 deaths. But this immunity did not last long, for in the second week in August 1898 the number of attacks rose from 3 in the week previous to 22. But the epidemic was not very severe, as the highest weekly figures recorded were 79 cases—49 fatal on the 30th September 1898.

Kurundvád (Junior) was not infected till January 1898, and then it only reported a few sporadic cases. However, from July 1898 to January 1899 a moderate epidemic took place, as the following statement shows :—

Months.						Cases.	Deaths.
July	1898	...	...	...	...	101	75
August	"	...	...	...	...	91	65
September	"	...	...	...	...	390	285
October	"	...	...	...	...	429	388
November	"	...	...	...	...	294	236
December	"	...	...	...	...	135	119
Total ..						1,440	1,168

There were 1,878 cases—1,528 deaths in all in this State between January 1898 and June 1899.

Jamkhandi State was attacked in the week ending 9th September 1898 and reported 15 cases—2 deaths. The source of infection is unknown, but is probably due to importation from Súngli or Kurundvád (Junior), which were both having particularly severe epidemics at the time.

The epidemic lasted 7 months, and was worst in November 1898, when it gradually began to subside.

The following statement gives the figures for the epidemic, month by month :—

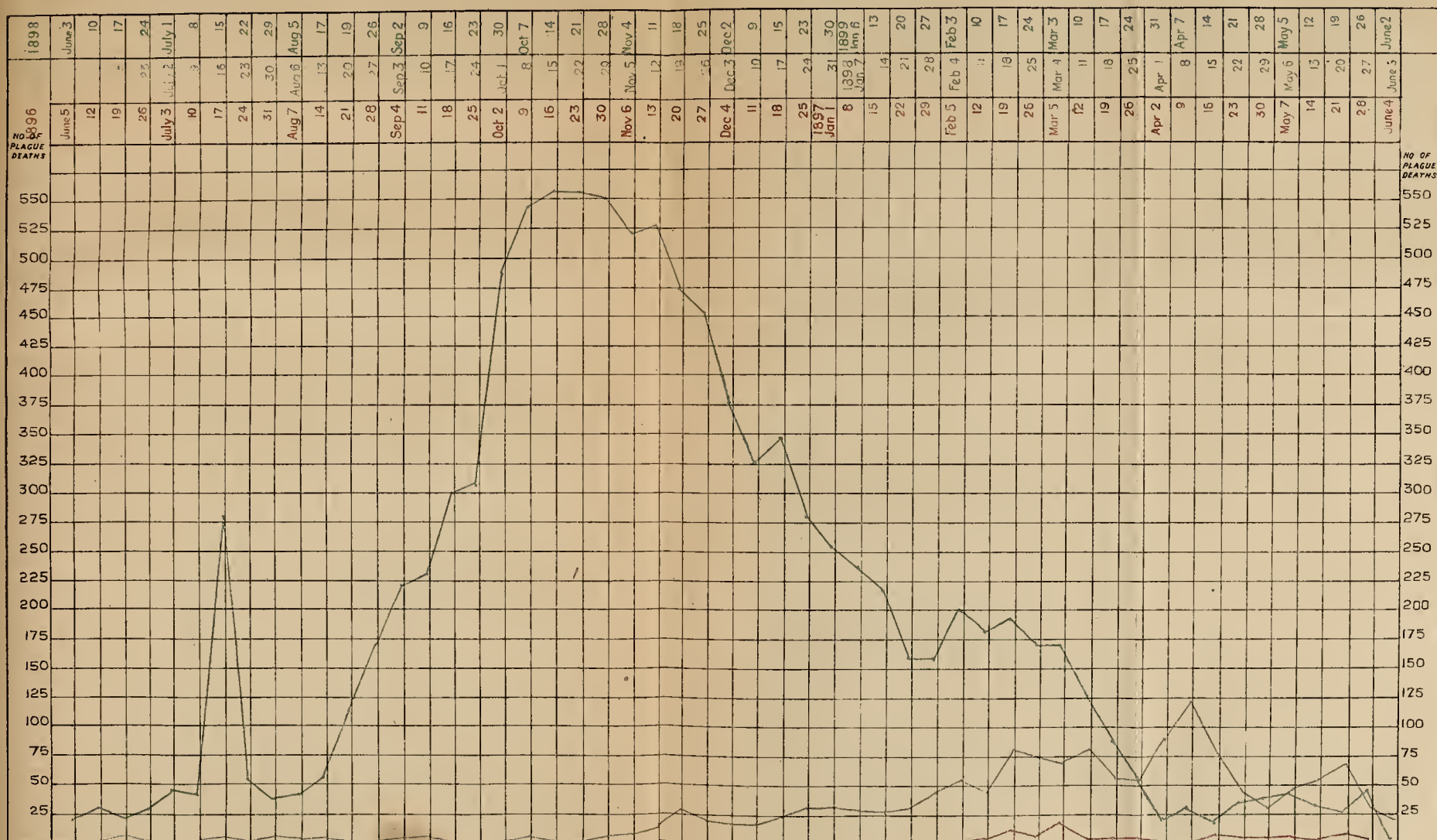
Months.						Cases.	Deaths.
September	1898	...	...	...	...	198	115
October	"	...	...	...	...	120	451
November	"	...	...	...	...	818	589
December	"	...	...	...	...	764	625
January	1899	...	...	...	..	237	197
February	"	...	...	...	...	209	147
March	"	...	...	...	...	120	88
Total ...						3,066	2,212

The remaining State, Rámdurg, was the last to succumb (December 1898), but up to May 1899 has only returned 238 cases—179 deaths, or a weekly average of 14 cases—11 deaths nearly.

Rámdurg State.
Population—36,181.

KOLHAPUR AND SOUTHERN MAHRATTA COUNTRY

Chart showing Plague Mortality.





PALANPUR STATE.

Area	...	...	...	...	7,775 sq. miles.
Population in 1891	...	...	...	...	645,526.
Density of population	...	...	...	...	83.02 per sq. mile.
Rainfall	...	...	...	...	Average, 26 inches.

Situated in the north-west of Gujarát to the east of Cutch, the District is bounded on the north by Márwár and Sirohi; on the east by the Mahi Kántha; on the south by the Gaikwar's territory; and on the west by the Runn of Cutch.

Boundaries.

The year has four seasons, hot and dry, rainy, hot and moist, and cold. In the hot and dry season, the heat, even in the Pálanpur territory, is great; and in the north towards Márwár, and in the west towards the Runn, it is intense.

Climate and natural features.

The thermometer rises to 120° in the shade, and the hot winds are so fierce as to keep even the people of the country from travelling during the daytime. Especially away from the hills and near the Runn, the rains are slight.

The third season, September, October and November, is very unhealthy. Both Europeans and natives suffer from fevers of a bad type. November, December, January and February are pleasant, and for Europeans, healthy, the cold, especially towards the Runn, being at times very great.

Except in hollows, where it is clay, and near the Runn, where it is mixed with black earth, the soil in the plain country is sandy.

The District contains no natural lakes, but, especially in Rádhanpur, has many ponds.

Close to the hills the water is very near the surface, but gradually sinks in the sandy western plains. Towards the Runn, water is specially scarce and blackish, and, in this part of the District, a scanty rainfall causes the greatest hardship.

In the year 1815-16, the Districts of Rádhanpur, Sami and Munjpur, were visited by a disease very like plague and so fatal that it carried off about one-half of the population. The disease appeared under two forms, one with swellings in the arm-pits and groin, and the other with fever and spitting of blood. Except when the buboes suppurated and discharged freely, the patient seldom recovered. No treatment proved of any avail.

Previous epidemics.

Fever is very prevalent from the middle of September to December.*

Plague was introduced in the Pálanpur State by a Jain Bania who went to Pálanpur Town in February 1897 from Bombay. As the epidemics in the State at large and in the town comprised separate periods, it is convenient to review them separately.

First Epidemic.—Plague was at first confined to one part of the town and to the Jain community alone, but it gradually spread and resulted in a slight epidemic during March and April 1897. On the 2nd of April, Captain H. F. Cleveland, I. M. S., arrived on special duty, and on the same day Dr. J. A. Lowson visited Pálanpur. The measures taken under their direction resulted in the rapid

*Bombay Gazetteer, Vol. V.

disappearance of the plague. The statistics are untrustworthy, but the total reported figures from the date of the original outbreak in February 1897 to the 15th May 1897 were 141 cases and 90 deaths. From the 15th May to the 2nd August 1897 no case was reported.

Second Epidemic.—On the 2nd August 1897, 2 cases occurred. The origin of this outbreak is obscure. Importation must be set aside after the definite statement of Lieut.-Colonel F. H. Jackson, Political Superintendent—

“Dr. Cleveland duly came and inspected the arrangements made by the Darbár and informed me that he was satisfied with them. He cannot say how the plague made its reappearance, *but it has certainly not been imported*. He thinks that a house that was closed at the time of the first period of plague might have been re-opened without going through a course of disinfection, but that this was the case cannot be determined by facts. At any rate the plague commenced again in the immediate vicinity of the place where it left off the first time.”

Note.—Lieutenant Rainier states that the second outbreak originated in the same chawl in which the first case has occurred.

The following measures were at once introduced:—

- (1) Segregation.
- (2) Observation camps.
- (3) Disinfection (of houses, &c.).
- (4) Medical inspection.

Observation camps were established at Decsa Station and Abu Road. Medical inspection, which had been in force from the beginning of the year, was continued at Pálanpur Station.

Up to the end of August no serious rise in the mortality took place; but on the 4th September the week's figures were 39 cases—26 deaths, although this includes some concealed cases. During this week 5 dead rats were found. The following week (4th—11th September 1897) the figures were 49—24, and cases still continued to be concealed. In consequence, the Darbár offered rewards for the discovery of cases; and the ward system was introduced (11th September 1897), the town being divided into four wards, which were visited by four search parties. Spread of infection by rail to the north was checked by examination of out-going passengers by Assistant Surgeon J. P. Wadia and a Hospital Assistant. A serious rise in cases and deaths during the next week, 11th—18th September, was, perhaps, in some measure due to unfavourable weather, heavy showers of rain, with an intermittent cold wind being severely felt by the people in segregation camps.

Up to this time the Political Superintendent had no skilled European assistance, but on the 22nd September 1897 Lieutenant N. Rainier, I. M. S., took charge of the operations; and he thus describes the measures in force on his arrival:—

“(1) For the different classes of inhabitants four hospitals, and attached to each a segregation camp, to which were removed the sick with their attendants, and the inmates of the neighbouring houses.

- (2) Search-parties of Darbár sepoys, but with no responsible official in charge of them.
- (3) A rough disinfection of infected houses with a solution of 1—20 carbolic acid.”

On these arrangements he comments as follows:—

“These arrangements were found not to work satisfactorily owing to a strongly rooted objection amongst the people to hospitals and segregation camps, and the apathy of the search-parties, who, sympathising with the people, could not be depended on to give much help or timely information, in many cases information being delayed until the neighbours had had time to remove to a different locality.”

In order to overcome these difficulties, Lieutenant Rainier turned to the native gentlemen appointed to supervise the four wards into which the town had been divided; the

search-parties were placed directly under them, and each supervisor, with the help of his search-party, daily inspected his quarter. Lieutenant Rainier adds:—

“Two or three times a week I, with the medical subordinates, accompanied the ward supervisors in their search, thus ensuring a complete and simultaneous examination of the whole city.

“The influence of these gentlemen induced the search-parties to give earlier information and ensured the inhabitants of the infected block being removed to a segregation camp, although many still managed to escape to other parts of the city and to the mango-groves outside.

“When it was found that in the latter place they were not interfered with, and that only chowkidárs were posted to give information of fresh cases, they speedily removed themselves and their sick thither.”

The disease was gradually subsiding, when the celebration of the Diváli festival caused the people to go back to their houses. The result of this was a fresh access of virulence. On the 28th and 29th of October 1897, Mr. A. Wingate, Plague Commissioner, Colonel G. W. R. Hay, I. M. S., and Major A. V. Anderson, I. M. S., Inspecting Plague Officer, visited Pálanpur and advocated complete evacuation, thorough disinfection of persons, clothes and buildings, &c., together with some other minor measures, most of which were promptly carried out with excellent results.

As regards the value of evacuation, the ward system, and other measures, the following remarks by Lieutenant Rainier are interesting:—

“To the better organization of search-parties, the voluntary removal of infected households to the mango-groves and to the great decrease in the population (many people having fled to the surrounding villages) must be attributed the decline of the disease which marked the eighth to the eleventh week of the epidemic.

“Unfortunately the occurrence of the Diváli festival caused a great number of people to return to the city, resulting in a rapid increase of the disease.

“The week after the Diváli most of these people had returned to the villages. Probably at this time they laid the foundation of the epidemic in the districts, though one or two villages were already infected. About this time (28th October 1897) the Plague Commissioner arrived and advocated the complete evacuation of the city. This was done by the 2nd November, about 8,000 or one-third of the normal population building huts for themselves in the open areas round about the city, the remainder making good their escape to the villages. The effect of this operation, combined with the increasing confidence of the people, leading them to voluntarily report cases and submit to segregation, was at once apparent. By the end of November the epidemic was practically at an end.”

On the evacuation of the town, the ward system was continued in the areas outside it, each Superintendent keeping a register of the person living under his supervision.

The figures for the months during which the epidemic lasted are given below:—

Month.								Population. (Census of 1891.)	Cases.	Deaths.
August	1897—4 weeks	...	...	...	...	...	...	21,092	31	17
September	„ —4 „	...	...	...	...	...	...		251	151
October	„ —5 „	...	...	...	...	...	...		295	182
November	„ —4 „	...	...	...	...	...	...		84	60
Total								.....	661	410

It is instructive to compare these figures with those of Násik, in which the same measures were tried, and the months of November 1897 for Pálanpur and of January 1898 for Násik are therefore given in full:—

Week ending	PALANPUR TOWN.			Week ending	NASIK TOWN.		
	Population. Census of 1891.)	Cases.	Deaths.		Population. (Census of 1891.)	Cases.	Deaths.
November 5th, 1897*	21,092	44	37	January† 7th, 1898.	24,429	49	45
„ 21st „		24	2	„ 14th „		23	32
„ 19th „		9	7	„ 21st „		18	12
„ 26th „		2	4	„ 28th „		7	9

*Palanpur.—Evacuation complete on 2nd November 1897.

†Nasik.—Evacuation complete on 10th January 1898.

Re-occupation was begun on the 15th December 1897. After re-occupation several imported cases were found, one of which was concealed in various quarters of the town for some ten days; but by always evacuating and disinfecting large areas round each imported case, indigenous plague was avoided up to the week ending 31st March 1899, when 2 cases with 1 death were reported. Some 9 cases, all of which proved fatal, occurred in the next two weeks, but there have been none since. The total number of cases was 674 (including January and February), and of deaths 413; percentage mortality, 61·2.

In spite of the epidemic in Palanpur Town during March and April 1897, plague was not reported from any other part of the State till October 1897. Lieutenant Rainier was single-handed, and, beyond paying flying visits to the affected villages, could not do much towards combating the epidemic; and the infection spread to no less than 53 villages. In each case it is said to have been clearly traced to persons arriving either from the town or from infected village.

In the month of November three Staff Corps Officers arrived for the purpose of supervising the arrangements in the villages and carrying out disinfection work. From October to the end of December 1897, the system of obtaining information of fresh cases was somewhat defective, the Patel and Haváldár making a daily inspection of the village for detection of suspicious cases only. But from the beginning of January 1898 to the end of the epidemic in April, all cases of sickness or death were reported daily, and the infected circle divided into four quarters, each in charge of an European officer, who was accompanied by a native gentleman, a medical subordinate, and one or more disinfecting parties. Lists were also kept up of villages in each quarter and of the inhabitants of each village, and a system of roll-call instituted.

Evacuation, too, was, as a rule, carried out partially in most of the villages attacked during the former period, except when it was found that cases continued to occur in different quarters of the village. Thus, out of the 25 villages infected between October and December 1897, 8 only were at once completely evacuated; the rest were partially vacated, but had eventually to be wholly cleared. In these villages 407 cases with 302 deaths occurred up to December; and 209 cases and 152 deaths afterwards, the average mortality being over 73 per cent. During the latter period, it was decided to carry out immediate and complete evacuation on first report of plague or discovery of dead rats in any village. Twenty-eight villages were attacked during this period, and the people of all except 5 villages, which could not be immediately evacuated, were turned out with the following result, 337 cases, 202 deaths and 60 per cent. case mortality.

Re-occupation was allowed after 21—28 days from the date of the last case. With a few exceptions, each village community was medically examined before re-occupation. The

introduction of the lists rendered this work comparatively easy. The names of absentees were given to the village Patel with instructions to detain them under observation for ten days outside the village.

Out of 53 villages, 5 only were re-attacked after re-occupation. In two cases the villages were found to have been very imperfectly cleaned, dirty rags, etc., being found in many of the houses. It is most probable that the site was still infected when the villagers returned. In two villages, though indigenous cases occurred, the first cases were imported. These villages were then partially evacuated and cleaned, and no further cases occurred. In one village the villagers themselves were infected and had concealed their cases in order to be allowed to re-occupy their village. This village and one of the two badly cleaned villages were again completely evacuated and thoroughly disinfected: the other village was only partially emptied and cleaned. In none of the five villages was re-occupation followed by a further recurrence of plague.

A curious feature of the epidemic in this State was the small number of dead rats observed. In the town it was quite exceptional to find them, even when disinfection was being carried out; and 3 was the largest number ever found in one house. In the first few villages infected, no previous history of rat-infection could be obtained and very few rats were found. In those infected later, dead rats were found, and 9 villages were evacuated on this account alone. This step was afterwards justified, as cases actually occurred in all these villages.

The following table compares the results in the town and the villages:—

	Population.	Cases.	Deaths.	Mortality per cent.	Case incidence per mille.	Average duration (first to last case in days).	Number of Villages.
Palanpur Town ...	21,092	674	413	61.2	31.9	1.53	1
Total villages, excluding Palanpur ...	57,934	953	656	66.8	15.5	31.3	53
Villages not immediately evacuated ...	36,031	616	454	73.7	16.0	46.6	22
Villages immediately evacuated ...	21,633	337	202	59.9	15.0	14.1	31

The number of cases and deaths, month by month, was as follows:—

Month.				PALANPUR STATE (excluding Palanpur Town).		PALANPUR TOWN.	
				Cases.	Deaths.	Cases.	Deaths.
August 1897—4 weeks	...	...	...	...	...	31	17
September " —4 "	...	...	...	...	...	251	151
October " —5 "	...	...	...	23	16	295	182
November " —4 "	...	...	...	167	110	84	60
December " —5 "	...	...	...	293	219	6	1
January 1898—4 "	...	...	...	210	130	3	1
February " —4 "	...	...	...	108	79	3	1
March " —4 "	...	...	...	127	82	1	...
April " —5 "	...	...	...	25	20	...	...
Total ...				953	656	674	413

From the end of April 1898 plague ceased, and the State was free from it till the end of September 1898. There has fortunately been no third epidemic. Towards the end of September 1898, the village of Dantiwada, 14 miles from Pálanpur Town, was infected by a Baroda village, and 18 cases and 7 deaths were reported in the first week (22nd—29th September). Prompt evacuation was resorted to, and, as a result, plague died out here in two weeks, after 25 cases and 16 deaths in all had been returned. Some more villages were attacked in February and March 1899, but the number of cases reported is not large. The last case reported was in the week ending 14th April 1899.

Since the end of May 1899 the Pálanpur State has enjoyed exceptional immunity from the disease, for, save for one fatal imported case returned for the week ending 23rd June 1899, there has been absolutely no plague there up to time of writing (September 1899).

REWA KANTHA AGENCY.

Area...	...	...	...	...	...	...	4,837 sq. miles.
Population in 1891	...	...	...	...	...	...	726,056.
Density of population	...	...	...	...	...	...	150.10 per sq. mile.
Rainfall	...	...	...	...	...	...	From 35 to 40 inches.

A large number of States, many of which run, as it were, through the Panch Maháls District and divide it into two, form the Rewa Kántha group. This group comprises an area of about 4,800 square miles, with a population of some 725,000. Although the majority of the States are self-governed, the whole group is under the control of the Collector of the Panch Maháls, who is also Political Agent, Rewa Kántha. A review of plague in the Rewa Kántha Agency may, therefore, appropriately find a place here.

Rewa Kántha is about 140 miles from north to south, and varies from ten to fifty from east to west. It is bounded on the north by Mahi
 Boundaries. Kántha and Meywár; on the east by the Panch Maháls and the Bhopavar Agency; on the south by the Ghekwar's territory; and on the west by Broach and Kaira.

In the forest-covered tracts of eastern Rewa Kántha, with large areas of land rich in
 Climate and natural features. springs, the cold is about January sometimes very severe, ice forming on pools, and the crops suffering severely from frost. The hot weather lasts from the middle of April till after a good fall of rain in July. The heat, too, is sometimes very severe, the thermometer in the shade in Lunávada and Báriya standing at 108° and 110°. In 1873 the heat was so great that several people died of it and bats and monkeys fell dead from the trees.

Healthy in the open parts, the climate of the eastern hill and forest tracts, especially of Báriya and Rajpipla, is very sickly. Fever, present throughout the year, is commonest in September, October, and part of November, when the waterpools and rank forest growth of the rains are drying up.

In the hilly parts the soil varies much, but in the open districts it is black throughout. Except a few tracts of rocky and inferior black soil, the Rewa Kántha is on the whole fertile.

Previous epidemics. There is no previous history of plague in this District: cholera being hitherto the only source of epidemic disease therein.*

Although two imported cases had been detected at the Poicha Detention Camp in Rajpipla Territory, outside the village of Poicha, no indigenous cases occurred up to November 1898, except at Chándod, where plague appeared in March 1898.

Chándod.
 Population—3,271.

* *Bombay Gazetteer*, Vol. VI.

The following are the monthly figures for Chándod from the commencement:—

Month.				Cases.	Deaths.
March	1898	...	...	20	14
April	"	...	...	38	33
May	"	...	...	1	3
September	"	...	...	35	25
October	"	...	...	29	21
November	"	...	...	19	14
December	"	...	...	10	9
January	1899	...	...	...	1
Total...				152	120

First Epidemic.—Towards the end of October 1898, the mortality from fever in the town of Chhota Udepur rose above the normal, but no clear case of plague was detected until the 10th of the following month. The origin could not be discovered. The town was immediately divided into wards, which were searched for cases, and up to the 15th November as many as 15 cases were found, of which 6 proved fatal. During the second half of the month there were 20 cases with 18 deaths. The epidemic continued until the affected localities were completely emptied in the beginning of January 1899.

The following are the figures for the Chhota Udepur epidemic:—

Month.				Cases.	Deaths.
November	1898	...	...	35	24
December	"	...	...	31	17
January	1899	...	...	2	3
Total...				68	44

Second Epidemic.—The second epidemic in the Agency broke out in February 1899, with 14 cases in one week at a village called Sanor in the Sankheda Mewás. This village belongs to a petty Chief and is not under the direct administration of the Agency. The infection was established by means of frequent communication between the people of the village and an infected village of the Baroda Territory situated close to it. The village was promptly evacuated and escaped lightly. The last case was reported in the week ending 24th March 1899, when the Pándu Mewás was suddenly attacked, and reported no less than 66 cases and 40 deaths from four villages: one village alone returning 35 cases, and another 22. The vicinity of these villages to infected territory—British and Gáekwári—was the main cause of this outbreak. The infected villages were promptly and completely evacuated, and arrangements made for the isolation of contacts. The results were characteristic: plague, which had burst out here with such virulence, died out in two weeks, and has not, so far, revived.

The number of cases and deaths for the second epidemic is as follows: —

Month.				Cases.	Deaths.
February	1899	...	...	16	17
March	"	...	...	66	52
April	"	...	...	7	7
Total...				89	76

SAVANTVADI STATE.

Area	926 sq. miles.
Population in 1891	192,948.
Density of population...	208·37 per sq. mile.
Rainfall	143 inches.

Boundaries. Sávantvádi, about fifty miles long and from ten to thirty broad, is a compact territory, unbroken by the lands of any other States or Districts.

Bounded on the north by the Málvan sub-division of Ratnágiri, it is separated by the line of the Sahyádri hills, on the north-east, from the lands of Kolhápur, and on the east and south-east, from the Belgaum and Bidi sub-divisions of the British district of Belgaum. To the south lie the Dicholi and Pedna sub-divisions of the Portuguese territory of Goa, and on the west and north-west, the Ratnágiri sub-divisions of Vengurla and Málvan.

The cold season begins about the middle of November, the weather very suddenly changing from damp warmth to dry cold. From February to the middle of May strong gusty winds blow from the north-west. The hot weather begins in March, when at times, in the afternoon, with a heavy cloudy sky, the thermometer rises to 94°. In April, the hottest month in the year, mists and fogs are sometimes followed by thunder, lightning, and rain from the north-east. May, though it has a higher average temperature than April, is freshened by a strong sea-breeze. The rainy season begins early in June and ends about the middle of October.

The soil is chiefly a light sand full of stones and gravel, and unable to yield the better class of crops. In the north is a deep red soil, the result of the decomposition of some of the lower trap flows. None of the rivers are of any considerable size: the Sávantvádi rivers, rising from the western Sahyádri slopes and passing west to the sea, displaying much sameness of character.

There is no authentic record of plague in the Sávantvádi State previous to 1896.*

The Sávantvádi State affords a good instance of the efficacy of surveillance and cognate measures in excluding plague from a District or State when thoroughly and energetically put in force. It is bounded on the west and north by Ratnágiri District, on the south by Portuguese Territory, and on the east by Kolhápur and the Southern Marátha Country and Belgaum. Throughout 1897 and 1898, the two latter were almost constantly infected, and imported cases occurred as early as December 1896, ultimately reaching a total of 41, of which no less than 37 were fatal. Yet, up to October 1898, indigenous plague was unknown in the Sávantvádi State.

As early as October 1896, Mr. L. P. Walsh, C. I. E., the Political Superintendent, had called a meeting of the principal inhabitants of the Town and District, in order to impress on them the necessity for making arrangements to ward off plague, should it approach; and to deal with it, should it appear in the State. Dr. D. G. Dalgado, the Civil Surgeon, delivered lectures on the subject by special request, and every endeavour was made to make all classes clearly understand the position they had to face, and the need for aiding the authorities in the execution of such measures as might be deemed necessary.

* *Bombay Gazetteer*, Vol. X.

From November 1896 to March 1897, 26 cases were imported—all, with one exception, proving fatal—but each was at once detected, and prevented from establishing infection. This was rendered the more easy on account of the situation of the houses and dwellings throughout the Agency; for they all stand in their own compounds, entirely detached from each other. Patients were examined by a Medical Officer, their clothes burnt when necessary, their houses disinfected, unroofed, and in all cases vacated by the inmates. A shed was also erected outside the town for the treatment of patients.

Towards the end of the year 1897, when plague was raging in a severe form in Belgaum, Major H. M. Abud, I. S. C., who was then acting as Political Superintendent, opened an Observation Camp at Kumbheshvar at the foot of the Ámboli Ghát and another at Konal at the foot of the Rám Ghát. These Camps served the two principal routes from the infected districts; but there were also four foot-paths leading into the State from above the Gháts. These were effectively guarded by men of the Sávantvádi Infantry Corps.

Up to the middle of April 1898, all travellers were detained at these Camps for a period of seven days (after disinfection both of themselves and of their kit), a different warrant being allotted to the arrivals of each day; but subsequently only those found with suspicious symptoms were detained; the rest, after being inspected and disinfected, being allowed to proceed to their destination, where they were placed under surveillance for eight days.

The knowledge of the existence of a rigid system of inspection and detention at a place soon checks the importation of plague into it, and this was exemplified in Sávantvádi, where, between April 1897 and September 1898—a period of 18 months—only 4 imported cases occurred.

First Epidemic.—In October 1898, the State was subjected to the only epidemic it has known—if, indeed, an outbreak in a village of 137 souls, lasting for a month, and affecting 18 people, of whom no more than 6 succumbed—can be so termed. During the week ending 7th October 1898, a Mahár belonging to an infected village of the Belgaum District manages to evade the guard watching the different passes, and, cutting across the Gháts by an unfrequented path, visited a woman residing in the village of Fukeri, and, having communicated the infection to her, returned to British Territory, where presumably he died. The woman was attended in her illness by a relative, who belonged to the village of Shirwal, three miles distant from the Belgaum boundary. This relative, a man, caught the disease, and, returning to Shirwal, infected his village.

Within a week 15 people were attacked. Never was the origin of an outbreak more clearly traced. The outbreak was reported to Mr. Walsh on the 13th October 1898, and he thus describes the repressive measures adopted:—

“In order to prevent the spread of the disease to the neighbouring villages, the Awath of the village of Shirwal in which plague had broken out was at once surrounded by a cordon of Police and men of the Local Corps; huts were erected on a site some half a mile distant from Shirwal, to which all the inhabitants of the Awath were removed, but without being permitted to take any item of their clothes or bedding; these persons were disinfected, as was also any kit which they were allowed to take with them. The persons stricken with plague were placed in a separate shed, where they were treated by a hospital assistant, who, after some days' delay, was assisted by two inoculated attendants. All the huts in the Awath and all the clothes and bedding of the inmates thereof were burnt; the ground on which the Awath stood was first saturated with kerosine oil, which was then fired. The State Kárbhári was directed to appraise the value of the huts and property destroyed, and to

erect new huts for the villagers at the expense of the State, and further to feed the inhabitants so long as they were hindered by the military cordon from following their usual occupations. The cordon was removed on the 3rd December, having been maintained for 51 days."

The result was eminently satisfactory ; in the succeeding four weeks only 3 more cases occurred, and plague then ceased in Sávantvádi.

From October 1898 to April 1899 there occurred 11 more imported cases, of which 9 ended fatally. In May 1899 there was no case, either imported or indigenous. The following statement shows the monthly figures in the State for the whole period of review :—

Month.					IMPORTED.		INDIGENOUS.	
					Cases.	Deaths.	Cases.	Deaths.
November	1896	...	...	...	1	1	...	...
January	1897	...	...	...	7	7	...	...
February	"	...	...	...	16	15	...	...
March	"	...	...	...	2	2	...	...
December	"	...	...	...	2	1	...	...
January	1898	...	...	...	1	1	...	...
May	"	...	...	...	1	1	...	...
October	"	...	...	...	2	1	16	5
November	"	...	...	...	...	...	2	1
February	1899	...	...	...	2	2	...	...
March	"	...	...	...	4	3	...	...
April	"	...	...	...	3	3	...	...
Total					41	37	18	6

Since May 1899 the Sávantvádi State has continued to enjoy the same freedom from plague.

CHAPTER XII.

Part I.—Plague Commissions.

It has become the custom of all civilized nations to appoint, for the purpose of enquiring into all questions of the first importance or of universal interest, at such times as they assume peculiar prominence, a body of experts. Such a body of experts is termed a Commission, which may be defined as “a company of persons joined together in the exercise of some public duty or some public trust.”

One of the most notable instances of such a Commission—one indeed not nationally, but *internationally*, representative—was the great Peace Conference which lately sat at the Hague. The widespread ignorance concerning, and the terrible deadliness of, Plague; its long absence in epidemic form from Europe or its neighbourhood; the great progress made in every department of Medical science, since Medical science last had an opportunity of investigating it; the possibility of a wide spread of the disease from a central sea-port like Bombay, and the consequent necessity for all Governments to be intimate as well with its nature as with the measures necessary to prevent an outbreak, rendered the opportunity afforded by the present visitation, one not lightly to be neglected.

Accordingly, the Governments of Egypt, Austria, Russia, Germany, Italy, and Ceylon are seen sending formal Commissions and experts to Bombay to study the plague, while eminent *savants* from all parts of Europe and India visited Bombay and the surrounding country. The Government of Bombay itself appointed one Commission (Sir Andrew Wingate, Surgeon-General Cleghorn, and Col. Hay) to tour throughout the plague-affected districts, and advise on the measures to be adopted, and a second (the Plague Research Committee, see Chapters II. and III.) for the scientific investigation of the disease.

The theories and conclusions formed from the Hongkong epidemic were here put to a further test and developed; while the varying conditions of life, of climate, of atmosphere, of hilly country and the plains and the coast of crowded cities, and thin straggling villages, brought to light many an interesting fact about a disease full of riddles and surprises. The medical faculty, with a regard for human life, peculiarly its own, undaunted by many a failure, never relaxed its efforts, now trying new remedies, now endeavouring to invent a curative serum. The happy idea of prophylactic inoculation, first conceived by Mr. Haffkine, also deserves mention.

But much as Joint Foreign Commissions and individual scientists did—and they did much, although the results of their labours cannot be discussed here—there remained a great deal more to be done, as well in the interests of science as for the purposes of administration. A great many interesting facts had been collected. A few valuable deductions had been made. But there were still, in the words of the Government of India, “many valuable items of information to be ascertained from officers who have been employed on plague operations that have not been recorded in official reports; and there are also many circumstances connected with the outbreaks at different places which require to be locally examined by persons who can collate the facts and form conclusions which will be accepted by public as well as scientific opinion in respect of them.” Accordingly, the Government of India appointed the Indian Plague Commission consisting of—

Professor T. R. Fraser, M.D., LL.D., F. R. S., Professor of Materia Medica in the

University of Edinburgh, President of the Commission, and the following members :—
Mr. J. P. Hewett, C. I. E., I. C. S., Secretary to the Government of India in the Home Department ;

Professor A. E. Wright, M. D., Professor of Pathology in the Army Medical School, Netley ;

Mr. A. Cumine, I. C. S., a Senior Collector in the Bombay Presidency ;

Dr. M. A. Ruffer of the Egyptian Sanitary Department ; and

Mr. C. J. Hallifax, I. C. S., Secretary to the Commission.

The questions to which the Indian Plague Commission devoted themselves were :—

- (1) The origin of the different outbreaks of plague ;
- (2) The manner in which the disease is communicated ;
- (3) The effects of curative serum ; and
- (4) The effects of preventive inoculation.

They arrived in Bombay on the 25th November 1898, and at once proceeded to inspect operations and to record evidence. Local Governments and Administrations and Native States were asked to put forward such witnesses, both official and non-official, as they desired to be examined, while the general public were invited by means of advertisements in the public Press to tender evidence before the Commission, which, after examining witnesses in Bombay for a week, visited Dharwar and Hubli *en route* for Bangalore, at which places they heard large numbers of witnesses put forward by the Bombay and Madras Governments and by the Mysore Administration. From Bangalore they proceeded to Hyderabad (Deccan), and on the way made a brief halt at Guntakul. Thence they visited in turn the Central Provinces, the Lower Provinces of Bengal, the North-West Provinces, and the Punjab.

But the Bombay Presidency claimed most of their attention. Karachi was visited on the 23rd January 1899, and after proceeding to Cutch Mandvi, Ahmedabad, Baroda, Surat and Damaun Road, the Commission once more arrived in Bombay, where they devoted a fortnight to taking further evidence and examining the various arrangements in force, the hospitals, the sea and railway inspection, segregation and sanitation. Bacteriological experts belonging to the I. M. S. and the R. A. M. C. conducted certain experiments for them at Bangalore and Bombay : whilst two medical officers were deputed by them to investigate bacteriologically the nature of the disease known as "Mahamari," at Kumaun and Garhwal.

On the 22nd of February 1899 the Commission left Bombay for the second time to visit other places in the Presidency, which had been seriously affected by Plague. Thus Poona, Satara, Belgaum, Bijapur, Sholapur, Ahmednagar, and Nasik were in turn inspected and evidence recorded at these places. On the 8th of March the Commission returned to Bombay, where a fresh batch of witnesses offered themselves for examination.

The witnesses examined by the Commission comprised all classes of officials and non-officials, experts and laymen, Civil and Military officers of all grades who had had anything to do with plague measures. European and Native scientists and medical men, *hakims* and *vaidis* were alike examined.

Whilst, on the one hand, a great deal of valuable evidence was given before the Commission, on the other, it must be noted that a considerable mass of less valuable theorising was offered, more especially by those who had formed pre-conceived or ill-founded opinions as regards the origin, spread and other circumstances connected with the disease. An amusing example of such evidence may perhaps be given here.

A scientific witness was being examined, the strength of whose pre-conceived objections to inoculation had apparently overcome his logical faculties. He was of opinion, he said, that the inoculation of one person was the direct cause of plague in some other uninoculated person. "Do you really mean to tell us," asked a certain critical member of the Commission, "that if in a family one person was inoculated and another person got plague, that the inoculation of the first member of the family would be the direct cause of the second being attacked?" "I do," said the witness solemnly. "On the same principle, then," the member continued, "you would argue that if in a family one member got married and another member got the measles, that the marriage would be the direct cause of measles?" "I would," said the witness, unhesitatingly. "Thank you," said the President, "we need not detain you any longer."

Evidence was taken in English as well as in vernaculars, always in public, and, wherever possible, in Town Halls and other public places. Facts and figures were called for and scrutinized, each witness being asked beforehand to submit an abstract of the main points on which he proposed to speak, and his statements thoroughly sifted. Sound theories, mature conclusions, bold propositions and cautious suggestions were heard, and considered side by side with crude notions and ignorant superstitions. Armed with this mass of evidence tendered by hundreds of witnesses, the Commission left for Europe on the 25th of March to hear further witnesses, to consider the evidence, and to write their report, which is at present nearing completion.

Mention should here be made of Mr. Francis Silva, of the Accountant-General's Office, who was Chief Clerk to the Indian Plague Commission throughout their tour; and who afterwards acted as Superintendent of the Plague Commissioner's Office, and whose assistance in the compilation of this volume has been of the greatest value.

CHAPTER XII.

Part II.—The Literature of Plague.

The literature of plague has now assumed such proportions that some attempt to classify and collate it, at least as regards such works as may be considered classics, will perhaps not be out of place here. The methods of classification which might be employed in such an attempt are many. The method adopted in this chapter is that of chronological order, supplemented by sub-divisions of the subject. It is not proposed, however, to discuss works on plague published before the year 1500 A. D. ; in other words, the starting point of the present synopsis will be that fell cycle of disease—the Black Death—which was the first really authentic visitation of plague in Europe, and whose identity with it is not open to question.* But in these outbursts of the pestilence, every country in Europe was involved : the dread disease was discussed in many tongues : and this fact has necessitated slight modifications in the original scheme of classification. These are so obvious as not to require further comment.

A number of works on plague were published in the 16th and 17th centuries. The greater number of these were written in Latin : but there were also many written in English, which were, however, of little medical value. Most of these works it is now impossible to procure ; and they are probably hardly to be found outside the Library of the British Museum. Of the Latin treatises the following may be mentioned :—

16th and 17th
Centuries.

- (1) Voehs, *Opusculum de Pestilentia*, 1537 ;
- (2) Georgius Agricola, *De Peste, libri tres*, Basel, 1554 ;
- (3) Victor de Bonagentibus, *Decem Problemata de Peste*, Ven. 1556 ;
- (4) Prosper Borgharutius, *De Peste*, Ven. 1565 ;
- (5) Hieron Mercurialis, *De Peste, præsertim de Veneta et Patavina*, Basel, 1577 ;
- (6) A. Massaria, *De Peste*, Ven. 1597 ;
- (7) Josephus Ripamontius, *De Peste*, in 1630, Milan, 1641 ;
- (8) Diemerbraeck, *Tractatus de Peste*, 1641-65 ;
[This work deals with the Nimeguen plague ; and is one of the most important on the subject.]
- (9) Athanasius Kircher, *Scrutinium Pestis*, Rome, 1658 ; Lipsig, 1671 ;
- (10) Cardinal Gastaldi, *Tractatus de avertendâ et profligandâ peste politico-legalis*, Bologna, 1684 ;
[This work is a splendid folio, written by the man who had the power to enforce his theories and ideas. The work is historically important, as it is one of the first which deals with quarantine and cognate matters. The mildness of the epidemic in Rome, of which the book treats, is said to have been due to the measures advocated and enforced by him.]

Of the English works on plague of this period, only one need be mentioned :—

- (11) Lodge, *Treatise of Plague*, London, 1603.

* See Introduction, page vi.

One Italian work may, perhaps, also be given :—

- (12) Fillipo Ingrassia, *Informatione del pestifero morbo . . . Palermo e Sicilia*, 1575-76.

The next batch of works on plague dealt with the Great Plague of London. Chief of these must be placed :—

- (13) Graunt, *Observations on the Bills of Mortality*, London, 1665 ;
 (14) M. F. Green, *A Calendar of State Papers*, 1665-66 ;
 (15) George Thomson, *Toimotomia, or The Pest Anatomized*, London, 1666 ;
 (16) Nath. Hodges, *Toimologia sive Pestis nuperæ apud populum Londiniensem Narratio*, London, 1672 (trans. by Quincy), London, 1720 ;
 (17) W. Boghurst (Apothecary), *Toimograchia, or An Experimental Relation of the last Plague in the City of London*.
 [This is merely a MS., but contains important details. It is in the British Museum.]

- (18) A collection of scarce pieces on the Plague in 1665, London, 1721.

Other pieces on this great historical outbreak call for less serious consideration :—

- (19) Defoe, *The Journal of a Citizen*,—

“which,” says an anonymous writer, “should be read and admired as fiction, but accepted with caution as history”; and

- (20) T. Vincent, (Minister of the Gospel), *God's Terrible Voice in the City*, London, 1667,—

a gentleman whose eloquence appears to have been equal to the occasion, whether he discussed theology or plague.

18th Century.

The plague literature of the 18th Century is characterized by a large proportion of French and German works. The French works, many of which were rather belated, were undoubtedly inspired by the terrible epidemics at Marseilles and Toulon in 1720, and in Russia and Poland in 1771. Taking the works which dealt with the 1720-22 epidemics first, the following may be mentioned :—

- (21) *Relation Historique de la Peste en Marseille*, Cologne, 1721 ; Paris, 1727, etc. ;
 (22) Chicoyneau, Verny, etc., *Observations et Reflexions . . . de la Peste*, Marseilles, 1721 ;
 (23) D'Antrechaux, *Relation de la Peste de Toulon en 1721*, Paris, 1756 ;
 (24) Lorinser, *La Peste des Orient*—

while the following deal with the epidemics of 1771 :—

- (25) Samoilowitz, *Mémoire sur la Peste en Russie*, 1777, Paris, 1783 ;
 (26) Mertens, *De la Peste en 1777*, Paris, 1784.

The German plague literature of this (the 18th) century comprised amongst other works :—

- (27) Adam Chenot, *Abhandlung von der Pest*, Dresden, 1776 ;
 (28) Schraud, *Pest in Smyrien*, 1795, Pesth, 1801.

The following English work of this period may also be mentioned :—

(29) Noah Webster, *History of Epidemic Diseases*, London, 1800,—
a work which contains no medical information, but connects plague epidemics with famines and other disasters.

The English plague literature of this period is scanty : doubtless because plague was fast disappearing from Great Britain and the neighbouring countries.

The plague literature of the present century is voluminous : English, Ger- 19th Century.
man, and French *savants* have all endeavoured to collect and classify the old records of this mysterious disease. Five writers, however, stand out as pre-eminent authorities previous to 1890. They are : English—Radcliffe and Payne ; German—Hecker and Haeser ; French—Tholozan. Their works may be roughly summarised as follows :—

ENGLISH.

- (30) J. N. Radcliffe, *Report of the Medical Officer of the Privy Council*, 1875.
- (31) J. N. Radcliffe, *Reports of the Local Government Board*, 1875, 1876, 1877, 1879-80.
- (32) J. N. Radcliffe, *Papers on Levantine Plague*, 1879.
[These papers were presented to Parliament.]
- (33) Colville and Payne, *Report to the Lord President of the Council*, 1879.
- (34) and (35) J. F. Payne also contributed the articles on “Plague” to the *Encyclopædia Britannica* and to Quain’s *Dictionary of Medicine*.

GERMAN.

- (36) Haeser, *Geschichte der Epidemischen Krankheiten*, Jena, 1882.
[This work forms the third volume of his *History of Medicine*, and is said to be the most complete medical history of epidemics extant.]
- (37) Hecker, *Vollskrankheiten des Mittelalters*, ed. Hirsch, Berlin, 1865.
[Hecker’s work on plague has been translated by Babington, and was published by the Sydenham Society in London, 1844.]

FRENCH.

- (38) Tholozan, *Histoire de la Peste Bubonique en Perse*, Paris, 1874.
- (39) Tholozan, *La Peste en Turquie dans les Temps Modernes*, Paris, 1880.
- (40) Tholozan, *Epidémies de Peste de Caucase*, Paris, 1879.

Other English works on plague which have appeared during this century are—

ENGLISH.

- (41) Calvert, *On the Plague in Malta*, 1813, Med.-Chi. Trans. vi. i.
- (42) MacLean, *On Epidemic and Pestilential Diseases*, London, 1817.
[This work is in two small volumes, and treats of yellow fever, plague and epidemic diseases generally. It is of little value.]
- (43) Faulkner, *A Treatise on the Plague*, London, 1820.
[A small volume dealing with the question of contagion: which he endeavours to prove is an attribute of plague from conclusions based on his own experience in the Malta epidemic of that time. It is interestingly written, and contains diagrams and maps ; but is of little practical value now.]
- (44) J. D. Tully, *History of the Plague in Malta, Gozo, Corfu, and Cephalonia*, London, 1821.
[An octavo volume of considerable interest.]

(45) F. Forbes, *On Plague in the N.-W. Provinces of India*, Edinburgh, 1840.

(46) White, *Treatise on the Plague*, London, 1847.

[Deals with the plague at Corfu.]

(47) Bascome, *History of Epidemic Pestilences*, London, 1851.

[Like MacLean, this work does not deal exclusively with Plague.]

The works of Drs. Pearson and Francis also deserve mention. They are scattered over various volumes of Transactions of Societies, but are valuable as containing the results of the first plague autopsies made by Englishmen. Up till quite recently, indeed, our knowledge of the morbid anatomy of plague was derived almost entirely from the works of the French physicians in Egypt in 1835-36.* In this connection the work of the Plague Research Committee (Capt., now Major, L. F. Childe's Department) was exceedingly valuable, and ranks at the present time as the chief authority on the subject.

GERMAN.

Three important works in German may be mentioned:—

(48) Lersch, *Kleine Pest, Kronik*, 1880.

[“A convenient short compendium, but not always accurate.”]

(49) Hirsch and Sommerrodt, *Pest-Epidemie in Astrakhan*, 1878-79, Berlin, 1880.

(50) Hoeniger, *Der Schwarz Tod in Deutschland*, Berlin, 1882.

FRENCH.

The French works on plague which appeared at this time were important:—

(51) Bulard, *De la Peste Orientale*, Paris, 1839;

(52) Clot Bey, *De la Peste en Egypte*, Paris, 1840;

(53) Prus, *Rapport sur la Peste*, Paris, 1846;

(54) Zuber, *La Peste D'Astrakhan en 1878-79*, Paris, 1880;

and lastly,

(55) Littre's *Dictionary of Medicine*, Art. “Peste,”

in which the French epidemics are synopsized.

But many works on plague have been published long after (sometimes as much as a century or more) the disappearance of the particular epidemic with which they deal. Such are—

(56) Richardson, *Plague and Pestilence in the North of England*, Newcastle, 1852;

(57) Sydenham, *Febris Pestilentialis et Pestis annorum 1665-66*, ed. Greenhill, London, 1844;

(58) G. Lambert, *Histoire de la Peste de Toulon en 1727*, Toulon, 1861.

Since 1890.

The outbreaks in Hongkong, in Egypt, in the Red Sea ports, and finally in this (the Bombay) Presidency have revived the interest in this disease, and have stimulated the exertions of many thousands to discover something more about it, and works on Plague, either large or small, comprehensive or of limited scope, have issued within the last few years. A brief catalogue or summary of these remains to be given.

* “Earlier observations are of no value, and in the later epidemics of Irak and Russia, none have been made.”—*Encyc. Brit.*

Since 1890 the literature of plague has much increased both in volume and importance. The outbreaks in Astrakhan (Russia), 1879-80 ; in Hongkong (China), 1890-96 ; Egypt, the Red Sea ports and India, 1896-99, have been seized as opportunities for studying and investigating plague in all its various branches, and much progress on many lines has been made. The chief types of the disease have been recognised and can now be to some extent diagnosed: the value of evacuation has been more firmly established ; and the experiment in prophylaxis has been crowned with a very large share of success.

Below are given some of the works dealing with plague since 1890.

- (59) R. Nathan, *The Plague in India, 1896-97*, Simla, 1898.

[Deals comprehensively with the first year of plague (1896-97) ; and is a very valuable work in 4 volumes. It contains maps, diagrams, statements, and embodies all the researches made and measures enforced in India up to the time of its publication.]

- (60) R. W. S. Lyons, *Report of the Plague Research Committee*, Bombay, 1897.

[This Report was written by Majors Lyons and Childe, I. M. S. It is probably the first medical authority on plague, and is of a remarkable excellence. Dr. Childe's share is perhaps a little loosely written from want of time. See Chapter II.]

- (61) *The German Plague Commission's Report*, Berlin, 1899.

[A comprehensive Report. The German Commission worked very hard, making a great many investigations and experiments, which are set down in full.]

- (62) N. Rainier, *Report on Plague in Palanpur, 1897-98*, Bombay, 1899.

[A short report but both interesting and instructive.]

- (63) *Report on the Outbreak of Bubonic Plague in Bombay, 1896-97*, Bombay, 1897.

[Chiefly administrative. Deals with the first few months of the outbreak in Bombay City. It was compiled under the orders of Mr. P. C. N. Snow, I. C. S., then Municipal Commissioner.]

- (64) and (65) *Report of the Bombay Plague Committee*, Bombay, 1898.

[Two such Reports issued for 1897-98. The first was compiled under the orders of General W. Gatacre, then Chairman ; and the second under the orders of Sir J. Campbell, I. C. S., who succeeded General Gatacre as Chairman. They deal with the progress of plague in Bombay City, and are, so to speak, in continuation of Mr. Snow's Report.]

- (66) M. E. Couchman, *Account of Plague Administration in the Bombay Presidency, 1896-97*, Bombay, 1897.

[Practically a record and review of administrative plague measures throughout the Presidency during the first year of plague. This work was compiled under the orders of Mr. J. DeCourcy Atkins, I. C. S. There is little original matter, reports and orders being embodied *in extenso*.]

- (67) E. L. Marsh, *On the Value of Perchloride of Mercury as a Disinfectant for Floors*, Glasgow, 1899.

[A diminutive volume, but valuable as being the first published results of a series of experiments in this direction. See book No. (71).]

- (68) F. G. Clemow, *Plague Epidemics in Russia*.

[A very interesting little book. The following quotations will serve to illustrate both style and contents:—

(1)

We may, therefore, pass over the epidemics of 1092 in Kief, of 1188 in Norgorod and some others, and come at once to the great outbreak of the middle of the fourteenth century—the Black Death of 1348-52. In Russia this truly terrible visitation was no less destructive than it was in the rest of Europe. It is curious to note that, while the Greek, Italian, and other Western writers regard China or “Cathay” as the place of origin of this pestilence, the Russian chroniclers state that it came from India. The infection seems to have entered Russia by two routes—one from the South-East, through the Caucasus and up the Volga, and a second and later one from the North-west, invading Pskof and Norgorod. It spared neither high nor low, rich nor poor. In Moscow it caused the death to the reigning Grand Prince (the title of Tsar was then unknown) and all his seven sons. The great Russian historian, Karamsin, has devoted but a few paragraphs of his history of this epidemic; but it is easy to see that it was a disaster of no ordinary kind. That it has left less impress upon the history of this nation than upon that of others may be due to the condition of the country at the time. The ravages and slaughter which invariably followed on a Tartar invasion left her scarce breathing time to notice the added horrors of the Black Death. And yet a Genghiz Khan or a Tamerlane might have envied the death-dealing powers of this pestilence, where they and their hordes, with all their thirst for blood, could but slay a few thousands, the plague numbered its victims by millions. Small wonder it is then that in a country so accustomed to wholesale slaughter by Tartar enemy from without or by rival rulers from within, the additional mortality caused by the Black Death did not effect those social or political transformations, which it has been shewn to have effected in the more advanced and settled countries of the West.

(2)

Another serious outbreak of plague occurred in 1709. Peter the Great was then at war with the Poles, and his troops were attacked by the pestilence somewhere near the frontier of the two countries. His efforts to quell the disease were most energetic and characteristic; and some of his measures, it may be added, were strikingly in accordance with modern practice. He caused the troops to be removed by sea from Marienburg to Revel. There they were landed and scattered over as large an area of country as possible; divisions were ordered to encamp so many miles apart, and regiments at least a verst (two-thirds of a mile) from each other. Some of his other measures were less to be commended. The cordon system was enforced with the utmost severity. Death was the almost invariable penalty for the least infringement of Peter's Plague Regulations. Gallows were erected on the public highways, and no trial was accorded to the unfortunate victim caught trying to break through the cordon; he was hanged at once without benefit of clergy. But then, as now, plague was not to be overcome by mere force, or to be exterminated at the point of the bayonet, like a regiment of Swedes or Poles; and the hero of Paltava for once found himself in the presence of an enemy whom even he could not subdue. In this epidemic it is stated that about a hundred thousand persons fell victims to the plague; and in the following year, when Peter was attacking the fortress of Riga, over 60,000 persons are said to have died from the disease. It is interesting to note that at that time, and also in the earlier epidemics, fumigation, which may be regarded as the earliest form of disinfection, was freely employed. Letters, for example, which had been brought by couriers from an infected district were passed through the smoke of a fire, were then copied out three times, and only the third copy was delivered to the addressee.

(69) *Report on Plague in the Jullunder and Hoshiarpur Districts, 1897-98.*

[Written by Major E. Inglis and other officers and published under the orders of the Punjab Government. There was little plague in the Punjab during the period dealt with, but evacuation was vigorously enforced, and is ably treated.]

(70) *Mysore Plague Regulations.*

(71) Mr. Haffkine, E. L. Marsh and Pitchford, *Experiments and Special Reports on Disinfection.*

[See book No. (67).]

(72) *Report of the Municipal Commissioner on the Plague in Bombay, 1898-99, Bombay, 1899*

[This volume, which contains a special report by Lieut.-Col. Wilkins, I. M. S., on the Plague Hospitals in Bombay City, continues the record of plague administration in Bombay City contained in Mr. Snow's, General Gatacre's, and Sir J. Campbell's Reports. It consists of two volumes, the second of which is composed of chart of mortality and diagrams of cases.]

(73) G. Hutcheson, *Mahamari, or The Plague in British Garhwal and Kumaon*, (published in the Transactions of the first Indian Medical Congress), Calcutta, 1895.

[Dr. Hutcheson's paper on Mahamari is a valuable contribution to plague literature, and foreshadows many of the measures and theories since adopted.]

(74) E. H. Cayley, *Report on the Period of Infection in Pneumonic Cases*, Bombay, 1898.

(75) G. Bainbridge, *Report on the Plague in Sind, 1896-97*, Karachi, 1897.

(76) E. L. Marsh, *Report on the Disinfection of Native Dwellings by Formaldehyde Vapour, with special reference to the utility of the apparatus of Lingner*, Bombay, 1899.

The volumes mentioned in this Chapter do not by any means cover the whole published works on plague. Many have been omitted because they possess little or no value : many others, valuable enough in themselves, have been omitted because they have been either embodied or incorporated in other mentioned works : of yet more no record is available. The researches of Wilm, Bitter, and other experts are synopsized in Nathan's comprehensive Report : of the researches of others, again, little or nothing is known. With a few exceptions, most of the works enumerated have, at various times, been accepted as the best authorities on, and records of, the pestilence in one or more of its many mysterious forms.

In conclusion, it may be added that during the past three years much progress has been made. The diagnosis of plague, at least in its commoner forms, has been differentiated from typhus and relapsing fever, and carefully established : the uselessness of the pharmacopœia is acknowledged : the micro-organism of the disease has been discovered and characterised : and a system of prophylaxis successfully attempted. All this, and much more, has been done. But although much has been done, much more remains to be done. Of the various—if they are various—causes which originate plague ; of the various methods by which it is disseminated ; of the life of the bacillus in nature ; of remedies after attack : of all these, and many other important points, we are ignorant. And even the discovery of what is known has necessitated the loss of many valuable lives, distress and misery inexpressible.

But what are these facts but illustrations of the great Truth—

*“ Knowledge by Suffering entereth,
And Life is perfected by Death.” **

* E. B. Browning—“ *A Vision of Poets*.”

INDEX.

1. District Histories have been briefly indexed on account of their brevity.
2. As a general rule only towns of 5,000 and over have been indexed, small towns not being considered of sufficient importance, except in certain special cases.

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NORTHERN DIVISION.

General View of Plague Cases and Deaths (by weeks) from the time of the first breaking out of the Plague in September 1896 up to May 1899.

Week ending	Bombay City Population 1,000,000				AMERICAN				EUROPEAN				MALAY				PANCH MARRA				SINHA				TOTAL				Week ending
	Plague		Total actual mortality from all causes	Total average mortality from all causes	District Population 1,000,000	Town Population 1,000,000	Other Places Population 1,000,000	District Population 1,000,000	Town Population 1,000,000	Other Places Population 1,000,000	District Population 1,000,000	Town Population 1,000,000	Other Places Population 1,000,000	District Population 1,000,000	Town Population 1,000,000	Other Places Population 1,000,000	District Population 1,000,000	Town Population 1,000,000	Other Places Population 1,000,000	District Population 1,000,000	Town Population 1,000,000	Other Places Population 1,000,000	District Population 1,000,000	Town Population 1,000,000	Other Places Population 1,000,000				
	Cases	Deaths																								Cases	Deaths	Cases	
1896																								1896					
September 24th	37	11																						September					
October 1st	115	35																						October					
October 8th	179	41																											
October 15th	111	31																											
October 22nd	147	41																											
November 5th	107	35																						November					
November 12th	107	35																											
November 19th	107	35																											
November 26th	107	35																											
December 3rd	107	35																						December					
December 10th	107	35																											
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December 24th	107	35																											
1897																								1897					
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February 1st	107	35																						February					
February 8th	107	35																											
February 15th	107	35																											

CENTRAL DIVISION

	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.	1920.	1921.	1922.	1923.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.	1932.	1933.	1934.	1935.	1936.	1937.	1938.	1939.	1940.	1941.	1942.	1943.	1944.	1945.	1946.	1947.	1948.	1949.	1950.	1951.	1952.	1953.	1954.	1955.	1956.	1957.	1958.	1959.	1960.	1961.	1962.	1963.	1964.	1965.	1966.	1967.	1968.	1969.	1970.	1971.	1972.	1973.	1974.	1975.	1976.	1977.	1978.	1979.	1980.	1981.	1982.	1983.	1984.	1985.	1986.	1987.	1988.	1989.	1990.	1991.	1992.	1993.	1994.	1995.	1996.	1997.	1998.	1999.	2000.	2001.	2002.	2003.	2004.	2005.	2006.	2007.	2008.	2009.	2010.	2011.	2012.	2013.	2014.	2015.	2016.	2017.	2018.	2019.	2020.	2021.	2022.	2023.	2024.	2025.	2026.	2027.	2028.	2029.	2030.	2031.	2032.	2033.	2034.	2035.	2036.	2037.	2038.	2039.	2040.	2041.	2042.	2043.	2044.	2045.	2046.	2047.	2048.	2049.	2050.	2051.	2052.	2053.	2054.	2055.	2056.	2057.	2058.	2059.	2060.	2061.	2062.	2063.	2064.	2065.	2066.	2067.	2068.	2069.	2070.	2071.	2072.	2073.	2074.	2075.	2076.	2077.	2078.	2079.	2080.	2081.	2082.	2083.	2084.	2085.	2086.	2087.	2088.	2089.	2090.	2091.	2092.	2093.	2094.	2095.	2096.	2097.	2098.	2099.	2100.	2101.	2102.	2103.	2104.	2105.	2106.	2107.	2108.	2109.	2110.	2111.	2112.	2113.	2114.	2115.	2116.	2117.	2118.	2119.	2120.	2121.	2122.	2123.	2124.	2125.	2126.	2127.	2128.	2129.	2130.	2131.	2132.	2133.	2134.	2135.	2136.	2137.	2138.	2139.	2140.	2141.	2142.	2143.	2144.	2145.	2146.	2147.	2148.	2149.	2150.	2151.	2152.	2153.	2154.	2155.	2156.	2157.	2158.	2159.	2160.	2161.	2162.	2163.	2164.	2165.	2166.	2167.	2168.	2169.	2170.	2171.	2172.	2173.	2174.	2175.	2176.	2177.	2178.	2179.	2180.	2181.	2182.	2183.	2184.	2185.	2186.	2187.	2188.	2189.	2190.	2191.	2192.	2193.	2194.	2195.	2196.	2197.	2198.	2199.	2200.	2201.	2202.	2203.	2204.	2205.	2206.	2207.	2208.	2209.	2210.	2211.	2212.	2213.	2214.	2215.	2216.	2217.	2218.	2219.	2220.	2221.	2222.	2223.	2224.	2225.	2226.	2227.	2228.	2229.	2230.	2231.	2232.	2233.	2234.	2235.	2236.	2237.	2238.	2239.	2240.	2241.	2242.	2243.	2244.	2245.	2246.	2247.	2248.	2249.	2250.	2251.	2252.	2253.	2254.	2255.	2256.	2257.	2258.	2259.	2260.	2261.	2262.	2263.	2264.	2265.	2266.	2267.	2268.	2269.	2270.	2271.	2272.	2273.	2274.	2275.	2276.	2277.	2278.	2279.	2280.	2281.	2282.	2283.	2284.	2285.	2286.	2287.	2288.	2289.	2290.	2291.	2292.	2293.	2294.	2295.	2296.	2297.	2298.	2299.	2300.	2301.	2302.	2303.	2304.	2305.	2306.	2307.	2308.	2309.	2310.	2311.	2312.	2313.	2314.	2315.	2316.	2317.	2318.	2319.	2320.	2321.	2322.	2323.	2324.	2325.	2326.	2327.	2328.	2329.	2330.	2331.	2332.	2333.	2334.	2335.	2336.	2337.	2338.	2339.	2340.	2341.	2342.	2343.	2344.	2345.	2346.	2347.	2348.	2349.	2
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(3) The figures for the months of April and May 1899 are taken from the Weekly Plague Progress Reports.

SOUTHERN DIVISION.

[illegible]

[2] The figures include both imported as well as indigenous cases and deaths.

(a) The figures for the months of April and May 1899 are partly taken from the Plague Progress Report.

(.) The figures include both imported as well as indigenous cases on 1 deaths.

(3) The figures for the months of April and May 1959 are taken from the Weekly Plague Progress Reports.



NATIVE STATES.

General View of Plague Cases and Deaths (by weeks) from the time of the first breaking out of the Plague in September 1896 up to May 1899.

C. D. STATES.										CUTCH.										KATHIAWAR.										KOLHAPUR AND SOUTHERN MALATHA COUNTRY.										PALNAPUR.										N. D. STATES.									
Week ending		↑ Akali. Population 76,774.		Anand. Population 65,146.		Bhar. Population 148,669.		Sethi Agency. Population 68,416.		Mandvi. Population 35,165.		Mundra. Population 10,433.		Other Places. Population 669,877.		J. Agency. Population 81,740.		Sethi Agency. Population 2,124,404.		Ratna. Population 8,321.		Kamthalia. Population 9,507.		Porbandar. Population 15,074.		Other Places. Population 2,718,701.		Kolhapur State. Population 93,331.		Maj. (Senior). Population 78,343.		Maj. (Junior). Population 4,457.		Sangli. Population 236,945.		Karmad. (Senior). Population 47,502.		Karmad. (Junior). Population 35,828.		Ratnag. Population 36,171.		Jamkhadi. Population 102,162.		Jath. State. Population 71,143.		State. Population 283,319.		Town. Population 21,092.		Other Places. Population 268,197.		B. K. State. Population 738,600.		S. K. State. Population 19,337.		Savantwadi. Population 162,948.			
Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.								
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Net—Diapers in the final roll-up of each state or Agency include figures for towns and also for other places. The figures include both indigenous as well as imported cases and deaths. The figures for the months of April and May, 1918 are partly taken from the Weekly Disease Diagrams.

* These figures are taken from Dathan's *Poquos in India, 1950, 1957*.

^a These include figures for Kildarepar from the commencement up to the 11th July 1976.

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